SCIENTIFIC AMERICAN

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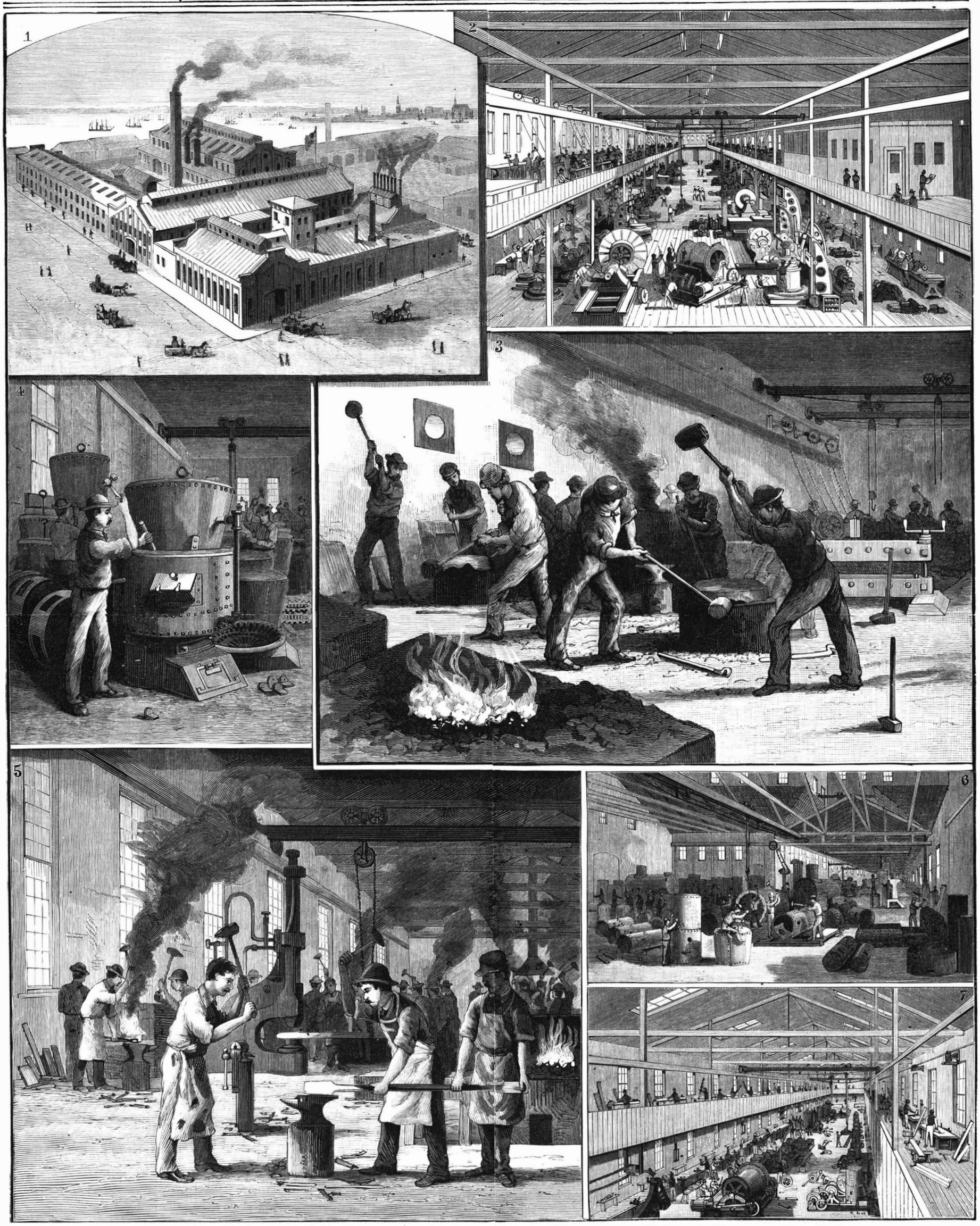

1. General View of Works. 2. Main Machine Shop. 3. Flanging Department. 4. Gorton Heater Shop. 5. Blacksmith Shop. 6. Boiler Shop. 7. Erecting Shop.

THE LIDGERWOOD MANUFACTURING COMPANY, NEW YORK—HOISTING ENGINES AND BOILERS—GORTON HEATERS.—[See page 341.]

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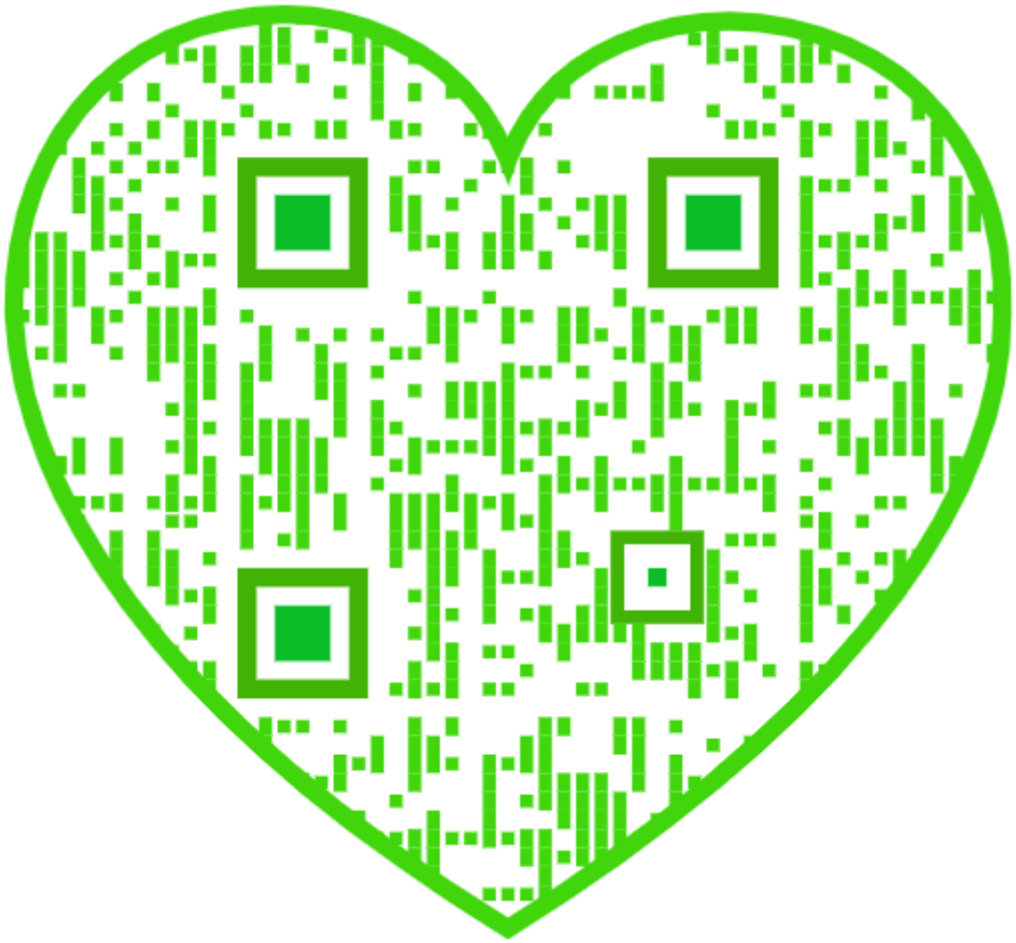

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POSITION OF THE PLANETS IN JUNE.

MERCURY

is evening star. He reaches his greatest eastern elongation from the sun on the 12th, at 3 h. P. M., and on that evening, and for a week before and after, is visible to the naked eye under the most favorable conditions that occur during the year. He sets nearly two hours after the sun on the 12th, and must then be looked for three-quarters of an hour after sunset in the northwest, forming a triangle with Pollux and Procyon. An opera-glass will aid the observation. Mercury sets on the 1st at 9 h. 8 m. P. M. On the 30th he sets at 8 h. 1 m. P. M. His diameter on the 1st is 6".6, and he is in the constellation Gemini.

JUPITER

is evening star. He will lead the heavenly host during the month of June, being beautiful to behold as he makes his way across the sky. He is still retrograding or moving westward, as observers may see who note the increasing distance between him and Beta Scorpii, the star he seemed almost to touch in May. Jupiter sets on the 1st at 3 h. 51 m. A. M. On the 30th he sets at 1 h. 47 m. A. M. His diameter on the 1st is 43".2, and he is in the constellation Scorpio.

MARS

is evening star. He has now changed his course, is traveling eastward, or in a direct course, and will continue to do so until the end of the year. He passes near Uranus for the third time since the year commenced. The conjunction takes place on the 6th, at midnight, Mars being 47′ south of Uranus. Mars sets on the 1st at 1 h. 41 m. A. M. On the 30th he sets at 0 h. 2 m. A. M. His diameter on the 1st is 13".2, and he is in the constellation Virgo.

URANUS

is evening star. He is chiefly interesting for his third and last meeting with Mars on the 6th. The two planets will not be in conjunction again until Mars has completed another revolution and returned once more to the neighborhood of his brother planet. Uranus sets on the 1st at 1 h. 46 m. A. M. On the 30th he sets at 11 h. 52 m. P. M. The diameter of Uranus on the 1st is 3".8, and he is in the constellation Virgo.

SATURN

is evening star. He is moving eastward, and will pass Præsepe during the month, grazing the cluster in his passage. His light grows dim as he approaches the sun, and recedes from the earth. He must be looked for in the west, east of Pollux and Procyon. Saturn sets on the 1st at 10 h. 51 m. P. M. On the 30th he sets at 9 h. 8 m. P. M. His diameter on the 1st is 16", and he is in the constellation Cancer.

VENUS

is morning star. She rises on the 1st only 32 m. before the sun, and is of course hidden in his rays. Venus rises on the 1st at 3 h. 53 m. A. M. On the 30th she rises at 4 h. 15 m. A. M. Her diameter on the 1st is 10", and she is in the constellation Taurus.

NEPTUNE

is morning star. He is near Venus on the morning of the 1st. Neptune rises on the 1st at 3 h. 54 m. A. M. On the 30th he rises at 2 h. 3 m. A. M. His diameter on the 1st is 2".5, and he is in the constellation Taurus.

Mercury, Saturn, Uranus, Mars, and Jupiter are evening stars at the close of the month. Venus and Neptune are morning stars.

The Kansas City Elevated Railroad.

Mr. George H. Pegram, the engineer who designed the above structure, writing to the *Railroad Gazette*, says:

The road was built in the summer of 1886. Coming 10 years after the New York roads, the structure might naturally be expected to embody some improvements, and it is believed that it does.

The material is steel, used at stresses ordinarily allowed in iron, which gives it a large reserve strength. The standard span is 48 feet (about 20 per cent longer than in New York).

The main feature of the structure is the absence of cross ties. Each rail is supported in a steel trough formed of two channels, connected together with bent plates near the bottom at short intervals in the length. Upon these plates rest wooden blocks 1½ inches thick, and upon these the rail, confined by bolts passing through the blocks and tie plates. The blocks may be replaced from below without removing the rail. The wood is used only as a cushion, the amount in an entire span being but little more than is contained in one cross tie of the New York roads.

The trough carrying the rail forms the top chord of the longitudinal truss, which has an eyebar bottom chord and triangular web bracing, all connected with large pins, or in order to avoid secondary strains and to prevent wear.

The troughs are stiffened and braced laterally by angle iron diagonals riveted between them.

There is the minimum obstruction to light, through the disuse of cross ties, and the tunnel-like appearance of the street under the structure is avoided. At the same time the greatest safety is insured. The wheels being in troughs are prevented from leaving the rails, and in the event of a broken axle the truck drops on what is in effect a pair of steel skids.

As was predicted, on account of the small amount of wood used and general character of the structure, the passage of trains is accompanied with very little noise.

Cholera on the Pacific Coast.

The recurrence of cholera in Chili will surprise no one who is acquainted with the nature of many of the South American cities and towns, and with the attitude of the Chilian and neighboring governments last year in imposing quarantine restrictions instead of commencing works of real sanitary improvement. During the three months ending March 17, the disease, which had been lying comparatively dormant during the cold season, broke out again, and led to a terrible mortality. The number of cases announced from official sources during the preceding twelve weeks amounted to 3,338, and of these 1,357 terminated fatally. But these statistics afford no true indication of the extent of the disease, and Dr. Gacitua has reported that between December 25, 1887, and March 3, last, there cannot have been many less than 5,000 cholera deaths in Valparaiso. No real abatement of the epidemic can under existing circumstances be expected until the advent of this year's cold season.—*Lancet.*

Nothing could be easier than transportation of this contagion from Chili to Panama, and thence to New Orleans, New York, and California. We hear of no precautions as yet taken.

Wood Fiber for Paper.

The extent of the manufacture of ground and chemical wood fiber for paper makers' use is not appreciated by those who have not investigated this industry. Certainly the Democratic members of the ways and means committee who have put this manufactured product on the free list, in the face of the fact that the duty now is only 10 per cent—less than it ought to be to protect the industry from Canadian and Norwegian competition—could not have fully understood the justice of such a step.

From a statement presented to the House by Congressman Dingley, it appears that wood fiber is manufactured in 21 States. The capital employed is about $20,000,000, number of men employed 22,000, tons of fiber made 225,000 ground wood and 112,500 chemical wood, value $12,375,000, cost of wood on the stump $1,235,000, and the remainder of the cost largely labor.

In Maine alone there are 84,000 pounds of ground wood fiber and 188,000 pounds of chemical wood fiber made daily. The ground wood fiber is made as follows:

Androscoggin Pulp Co., Brunswick	10,000
Indurated Fiber Co., North Gorham	12,000
Alvin Record & Sons, Livermore Falls	10,000
W. R. Shurtleff & Co., Skowhegan	4,000
J. S. Clapp, Snow Falls	4,000
Sebago Co., South Windham	18,000
Kennebec Fiber Co., Waterville	20,000
Total	Pounds, 84,000

The daily production of chemical wood fiber in Maine is as follows:

Poland Pulp and Paper Co., Canton	20,000
Somerset Fiber Co., Fairfield	20,000
Penobscot Chemical Fiber Co., West Great Works	40,000
Lincoln Pulp and Paper Co., Lincoln	14,000
S. D. Warren & Co., Cumberland	40,000
S. D. Warren & Co., Yarmouthville	40,000
Poland Pulp and Paper Co., Mechanic Falls	14,000
Total	Pounds, 188,000

The production and use of mechanical wood fiber began about 1868, and within a few years has rapidly increased. All the patents have expired except those on a recent process known as sulphite. The fiber has been greatly reduced in value, ground wood now bringing only 1¼ cents per pound, and chemical 3½ cents. The cost of paper has been reduced from nine cents before the war to about 4½ cents, in consequence of the development of the manufacture of wood fiber.

Before 1883, the duty on imported wood fiber, which is made in Canada, Norway, Sweden, and Finland, as well as in this country, was 20 per cent. In 1883 the duty was reduced to 10 per cent, and since that date foreign competition has increased. In 1886 there were imported 18,000 tons, in 1887 the importations were 32,000 tons, and this year about 53,000 tons will be imported. If wood fiber should be placed on the free list, as proposed by the Mills bill, our wood pulp mills would be speedily swamped by Canadian and Norwegian competition, as the labor costs only half as much in those countries.—*Lewiston Journal.*

The Sun an Incendiary.

The *Chemist and Druggist* (London) records the fact of a chemist shop just opened, at 16 High Street, with show bottles in the windows, which, acting as a burning glass, set fire to the store. It was discovered before much damage was done, but serves as another warning against placing show bottles where the sun can reach them in show windows.

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Modern Fortifications.

The London *Times*, in a recent article on metallic fortifications, says:

The plan of fortresses at present adopted—unknown to the public, but the divulging of which can do no harm, as it cannot remain secret—is very peculiar and quite opposed to any æsthetic or artistic conception. A fortress is henceforth composed of an immense block of concrete of incredible thickness. It will offer to the eye only a square, oval, or lozenge shape, the outside being a mere block without projections or access. It is not yet settled whether this block shall be surrounded by a trench, but all competent authorities in Europe seem to hold that one or several sheeted cannon shall move round the block, and as powder will in future be smokeless, this cannon, always in motion and escaping the enemy's aim, will fire on a fixed point. This movable sheeting will make up for the absence of trenches. At the angles of the block, moreover, if square, or elsewhere if it is round or oval, there will be sheeted reducts, which will cover the base of the block and make assault impossible. Of course the interior of the block will contain the equipments of a fortress. The entrance is underground, on the side opposite that where the enemy can appear. There will be air openings in the interior, which is lit up by electricity produced on the spot or at a distance. The magazine of projectiles is in a spot inaccessible to explosions caused by shells coming from without. The stores of other ammunition and of victuals are similarly protected. The hiding places for the men, and, in short, everything that has to be under shelter, are underground, and so placed as to be quite protected from the besiegers. Electric wires, both for messages and light, as also telephones, beyond the reach of the besiegers, protect the fortress against isolation—that is to say, against abandonment and discouragement. The underground existence of the garrison may not be very lively, and it will be well to accustom as many men as possible to it; but that garrison will not exceed thirty or forty men per fortress.

A fortress thus equipped for resisting the enemy's attack and fire of course requires special means of repelling the enemy, preventing him passing, and doing him all possible mischief. These means are the plated turrets which form the second portion of the experiments at Chalons. The fortress will in general have two steel turrets, one on each side, which by their circular motion can fire in all directions. The frontier fortresses will be so arranged that their fires meet, which is easy with the wonderful range of modern cannon.

The turrets of Saint Chamont and of the Chatillon and Commentry company have just been undergoing artillery fire. The first part of the experiments was the firing from these turrets. The second consists in their being cannonaded and shelled. The Saint Chamont turrets are real turrets of cylindrical shape, with a rounded top, which gives no hold for projectiles. The Chatillon and Commentry turrets, while of cylindrical shape, are but slightly rounded at the top, the surface of about six or seven square meters being slightly convex, but nearly flat, thus giving more hold to projectiles if they are supposed not to burst immediately on contact with the cupola. The Saint Chamont turrets project 90 or 95 centimeters from the surface of the block fortress, and are thus visible to the enemy. They can be only equipped, morever, on account of the shape of their cupola, by cannon of 155 millimeters, styled "cannons 155 short," whereas cannons "155 long," which measure 4·40 meters, project 40 centimeters from the turret during three quarters of the time required by the rotatory movement—that is to say, during 45 to 90 seconds for each discharge. Both the Saint Chamont and the Chatillon turrets are rotary, showing their port holes and cannons only at the very moment of discharge. The aim is no longer taken after ocular examination, but each fortress has a plan of its entire range of fire, cut into divisions as numerous as is possible for the working of the cannon. The officer in command of the fire is stationed in an observatory inside, outside, or even, if necessary or possible, at a great distance from the fortress. He telephones to the officer inside the turret the numbered point on the plan from which the firing is to proceed. This order is transmitted to the pointer, and the cannon being placed on the point, the rotation begins. This movement to the point aimed at produces an electric shock, which makes the gun go off, while the turret continues to rotate, is again charged, and, altering its aim or not, begins a fresh fire.

The Chatillon company has made an important change in the arrangements of the turrets by adding to the rotatory movement an eclipse movement. In other words, the turret not only turns on itself, but by a counterpoise mechanism of extreme simplicity it drops down after firing. It does not then project above the ground more than fifteen centimeters, and can be easily disguised. It offers no hold on the sides, but only on the cupola, which is flatter than the Saint Chamont one. As to accuracy of fire, the general opinion, confirmed by the recent experiments, is that the eclipse turret is twice as accurate as the merely rotatory turret. With the latter the fire is never fixed, seeing that to conceal the cannons from the enemy the turret is forced to continue its movement and to come back to the point of contact where electricity causes the discharge, whereas the eclipse turret, while rotative so as to fire in all directions, disappears after firing and reappears after being charged without rotatory movement—that is to say, with the precision of fixed firing. If, for instance, the electric contact during the rotatory movement has the slightest delay, the ball deviates, imperceptibly, it is true, at the starting point, but the deviation becomes comparatively considerable at the arrival point on account of the great distance. The eclipse turrets, moreover, are made of steel cast in a peculiar way, so as to be cheaper, more malleable, and consequently quite as resisting as other steel, being at the cupola fifty centimeters thick. The total weight of a steel turret is 120 to 190 tons, and it can fire every minute or every two minutes, according as steam power or manual labor is used.

Utilizing Niagara.

There have been so many false alarms about utilizing the wasted water power of Niagara Falls that one hesitates to accept rumors of new propositions as likely to be carried out. The latest one which appears to have any backing, though not altogether an original idea, is to tap the Niagara River at some distance above the falls by means of a tunnel driven along the side of the river. The water would be distributed by means of lateral underground conduits to turbines placed on the bank below the falls. These could give power direct to mills, factories, etc., and by electrical transmission, furnish light and power to Buffalo and neighboring towns. It is claimed that by adopting this system the scenery will not be disfigured, and that the amount of water drawn off will not appreciably lessen the quantity flowing over the falls. It has always been a source of wonder to those who have studied the ground that some plan has not long ago been adopted which would meet the engineering requirements without impairing the grandeur of Niagara. The first attempts were certainly not in the right line, the small power taken off by the paper mills, etc., being accompanied by a disproportionate injury.

Niagara is not to be measured by hundreds of thousands of horse power and millions of money, it is true; but the visitor's first impression is a vivid realization of the amount of waste perpetually going on, which might be avoided. The State and the country can afford to pay a good deal to keep up the show, but surely there is margin enough, without reducing Niagara to the condition of some of the smaller falls, where the water is turned on from a dam for the gratification of tourists who can afford the luxury.

Electrical transmission of power, which was thought not many years ago to be a mere dream of the cranks, is now shown to be of practical, economical utility. It has been adopted successfully in so many places and under such different conditions that it is reasonable to forecast a great future for it. So far as is known at present, it is the most promising mode of utilizing the natural forces, such as winds, currents, tides, and terrestrial electricity.—*Eng. and Min. Jour.*

Restoration of Faded Photographs.

The family album upon the drawing room table is a never-failing subject of interest to visitors, and among individuals who lack original ideas forms an agreeable subject of conversation in place of that of the weather. Of late years, however, there is more diffidence in placing it in prominent positions for the ready examination of waiting friends, the sad-colored pictures of "the hue of a November fog in Cheapside, or a bad piece of gingerbread spoiled in the baking," being at variance with average ideas of artistic elegance. A more serious aspect of the case is gradual discoloration or fading of the likenesses of members of the family who have passed away by death, raising the question in the minds of survivors what is to be done to preserve those lineaments for inspection, ere it be too late.

When the white parts of an ordinary photograph begin to turn yellow, that photograph is doomed unless immediate efforts be made to preserve it, and those efforts may not always be successful. Treatment with a weak solution of bichloride of mercury, under the hands of a skillful photographic practitioner, is one of the best methods of making the attempt. This may arrest decay, but will not restore the likeness to the condition of a first-rate photograph. Bichloride of mercury or corrosive sublimate is highly poisonous, and is best left alone by the uninitiated.

A better way of preserving the memento is to send the photograph to a platinum printing or carbon printing firm of photographers in a sufficiently large way of business to keep upon their premises artists skilled in the use of the brush and pencil. Their usual plan then is to obtain upon glass or paper an enlarged positive copy of the fading photograph. This copy is "retouched," that is to say, worked upon by hand, so as to remove obvious defects due to decay or to original bad work; a negative is taken from the perfected positive, and from this negative any number of copies may be printed by photographic means in permanent carbon pigments or in platinum black. To obtain the positive already mentioned, a primary negative has to be taken, so that two negatives are necessitated by the process, both of which, as well as the positive, are usually worked upon somewhat by the hand of the artist; the method of getting a good permanent photograph from a bad fading one is, therefore, complicated and requires skill.

In the carbon process, carbon or other suitable permanent pigment is spread upon paper or glass along with solution of gelatine and of bichromate of potash or ammonia. Where the light acts upon this surface through the negative, the decomposition of the salt renders the gelatine insoluble; consequently, when the paper is afterward placed in warm water, the gelatine unacted upon by light dissolves off in company with its pigment, thus leaving the white paper exposed; but where the light has acted, the gelatine and pigment remain to form the shadows of the picture. These are the broad principles of the process, omitting various practical details which it would exceed present limits to particularize.

The other permanent process, in which the dark parts of the picture are formed of platinum black, gives the most durable pictures known, platinum being a metal which has more power than gold of resisting change under atmospheric and other influences; indeed, platinum black is infinitely more permanent than the paper upon which it is printed. In some cases, either from badly prepared sensitized paper or from faults in the photographic manipulations, platinum prints have been known to turn yellow in the whites under the influence of sulphureted hydrogen; such discoloration has sometimes been subsequently removed by the application of chemical reagents, without the dark parts of the paper having been affected all through the operation.

There are methods of taking photographs in silver which have exactly the appearance of platinotypes, so that an expert cannot always tell the difference without the application of chemical tests; these black and engraving-like silver prints are in all probability much more permanent than the ordinary photographs used for the stocking of albums.—*Chambers's Journal.*

Be Inventive.

There are few expressions we hear more frequently than that feeble wail of the cowardly or lazy mind, "I can't!" Every day we see people who permit their progress to be stopped by trifles which, instead of retarding them, should spur every faculty up to the resistive, conquering point. "I can't" and "I forgot" are two fatal phrases which should be scratched from the vocabulary of every young man or woman who is ambitious of being or doing anything in this world that shall deserve to be recorded.

Be inventive. Cultivate the creative side of your brain. Don't be stumped. When you seem to be cornered is the very moment to stir yourself and devise some way of making things work.

The Chicago *Herald*, a little while ago, printed some remarks of a drummer descriptive of a certain Yankee's ingenuity, which are pertinent to our present theme:

"Talking about ingenuity," said the drummer, "I want to tell you what I saw last winter out West. I was on a train that was snowed in for three days. The company sent us food, but they didn't send any cigars, and the train boy's stock was exhausted the first day. In the express car we found and confiscated a box of smoking tobacco, but there wasn't a pipe on the train. Among the passengers was a Connecticut Yankee who was just dying for a smoke. He got out in the snow and looked around for a weed, or something of that sort, which he might use in making a pipe, but couldn't find a thing. 'I'm going to have a pipe, anyhow,' he said. So he took a lead pencil, opened the wood, took out the lead, and, placing the two strips together again, wound them tightly with the tin foil which came off the packages of smoking tobacco, making them air-tight. Then he took an apple, hollowed a bowl out of it, stuck his lead pencil stem into it, and had one of the nicest pipes you ever saw. If you don't believe it, make one for yourself some time and try."

This was a common trick in the army, when we could get neither reeds nor corn cobs, and sweet pipes they made in every sense. When apples were unobtainable, which was not seldom, we fell back upon potatoes.—*Amer. Art Printer.*

A New and Powerful Gun.

General Maitland, of the Ordnance Department of the War Office, speaking at the annual dinner of the foremen engineers, held in the Cannon Street Hotel recently, said he had just designed a gun of 22 tons, on Mr. Longridge's wire principle, which had recently been fired at Shoeburyness, the projectile being 380 lb., the range 21,000 yards, or twelve miles, and the velocity 360 feet per second.

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Innocent Wasp Stings.

W. L. Wilder imparts to the readers of *Science* the following, which he states to be a fact not generally known, which we can readily believe, *i. e.*, that, if one holds his breath, wasps, bees, and hornets can be handled with impunity. The skin becomes sting proof, and holding the insect by the feet, and giving her full liberty of action, you can see her drive her weapon against the impenetrable surface with a force that lifts her body with every stroke; but let the smallest quantity of air escape from the lungs, and the sting will penetrate at once. I have never seen an exception to this in twenty-five years' observation. I have taught young ladies with very delicate hands to astonish their friends by the performance of this feat, and I saw one so severely stung as to require the services of a physician, through laughing at a witty remark of her sister, forgetting that laughing required breath. For a theory in explanation, I am led to believe that holding the breath partially closes the pores of the skin. My experiments in that direction have not been exact enough to be of any scientific value, but I am satisfied that it very sensibly affects the amount of insensible perspiration. Who will test the correctness of Mr. Wilder's theory and report the result in behalf of science?

A Queer Animal.

In the report of the superintendent of the Zoological Society of Philadelphia, read at the annual meeting of the members on the 26th of April, Mr. Arthur E. Brown stated that perhaps the most extraordinary animal ever shown in the collection was the echidna (*Tachyglossus hystrix*), purchased on the 12th of April. As is well known, the lowest mammalian group, the *monotremes*, to which this animal belongs, possess structural peculiarities strongly indicating relationship to birds and reptiles, and additional evidence of the closeness of this connection has lately been given by the apparent confirmation of the previously suspected fact that both the echidna and its relative, the ornithorhynchus, lay eggs from which the young are hatched outside of the body of the mother, as in birds and many reptiles. The rarity as well as the remarkable nature of this animal caused it to be of great interest to zoologists, and it received as much observation as its subterranean habits would permit. Its native food being altogether of ants, and the structure of its mouth preventing it from taking solid food in any quantity, it was necessary to feed it on milk and eggs, on which it survived only some six weeks.

RUSSIAN MOUNTAINS AT PARIS.

The Russian mountains, which were formerly the delight of our fathers in the Beaujon and Delta Gardens, and in a large number of public places at Paris, disappeared in consequence of some serious accidents that happened through a defect in the construction of the plant. After long oblivion, these "mountains" made their appearance in America a few years ago, where they are very popular, and where they are called toboggan* slides, and in England, where they figured in 1886, at the Liverpool exhibition. They have likewise been operated in France at public fetes, and we now see them returning to the very heart of Paris, in an establishment which has just been founded on the Boulevard des Capucines, and which is now much frequented.

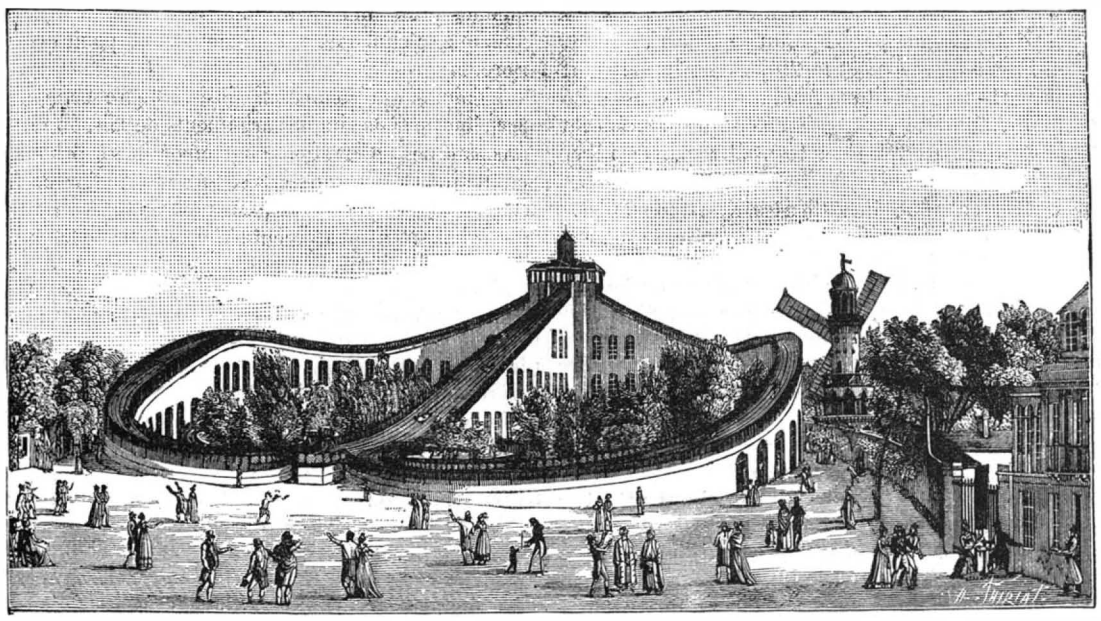

Fig. 1.—RUSSIAN MOUNTAINS OF THE BEAUJON GARDEN (1821).

In a preceding article, we gave a *resume* of the history of Russian mountains at Paris, and described the great installation at the Beaujon Garden, which was wonderfully successful in 1817 and for many years after. Since the publication of that article, we have been enabled to procure some new and interesting engravings of the time, that give a more complete idea of these ancient affairs, and we reproduce them herewith. Fig. 1 gives a general view of the Russian mountains in the Beaujon Garden. The inclined plane in the center allowed the travelers to ascend to the upper starting pavilion. The vehicles were drawn up this slope by cables. The cables were actuated by a horse whim. On reaching the upper pavilion, the travelers descended undulating slides to the right and left, which were about 1,300 feet in length.

The Russian mountains of this garden had imitators, and there soon appeared the Egyptian mountains of the Delta Garden, and the "Niagara Falls" of the Ruggieri Garden (Fig. 2). In this last installation, the starting kiosks were reached by an easy slope, and the passenger got into a small sled that seated but two persons. This sled slid down a very firm wooden inclined plane, and traveled about 160 feet in six seconds. We may now just as well say a few words regarding the origin of this sport, which has always succeeded in amusing the public.

Russian mountains are very ancient, and, as their name indicates, were first used in Russia. Precise historical documents seem to be rare and little known. In Fig. 3 we reproduce an old colored lithograph, and it is the only picture that we have been able to procure. It was made from an original drawing by Sauerweid. It is accompanied with the following text, which perfectly explains the organization and operation of the Russian mountains on the Neva:

"On the frozen surface of the Neva there are constructed two frames 40 or 50 feet in height, and 800 or 900 feet distant from each other, and inclined toward each other by a rapid slope of 55°, but not exactly opposite, in order that the descending sleds may not meet. Each descent is soon converted into a mountain of ice by the torrents of water that are poured on to it, or by the blocks of ice that are placed one after another over its entire length. The sled descends with fearful rapidity, and, with the same speed, traverses the level space between the two structures. This exercise is the principal amusement of the Russians during winter."

It will be seen that these Russian mountains were formed of a simple inclined plane covered with ice. Small sleds, seating one person, slid down these, and the speed acquired naturally slackened on the horizontal surface of the frozen river. The Russian mountains of the Beaujon Garden consisted of an undulating slideway in which there were ascents succeeded by rapid descents. The "Niagara Falls" had more resemblance to the genuine Russian mountains, but the vehicles, instead of being sleds, were cars mounted upon wheels that revolved in hollow rails. Such are the characters that distinguish the different systems of Russian mountains formerly constructed. We now come to the new installation of the Boulevard des Capucines, which has permitted us to recall these old souvenirs of the past. The organizer of these Russian mountains has dispensed with the wide spaces used by our fathers in the spacious gardens that existed in the center of Paris, and has had recourse to a court left free between two houses. A roof 275 feet in length protects the plant, which, at night, is very brilliantly illuminated by the electric light. The cars are provived with five benches, each seating two persons. The entire car therefore holds ten passengers. It runs, through wheels, over metallic rails provided with guard rails that render derailment impossible. The car travels with great speed down the undulating declivity, and rises and descends in succession, as shown in Fig. 4. The space passed over is about 260 feet. On reaching the end of the route, the passengers alight, and a gang of men pulls the car on to a turntable and directs it to the return track. Then the passengers resume their places and return to the starting point. The trip from one end to the other does not take more than twelve seconds, as has been ascertained by a

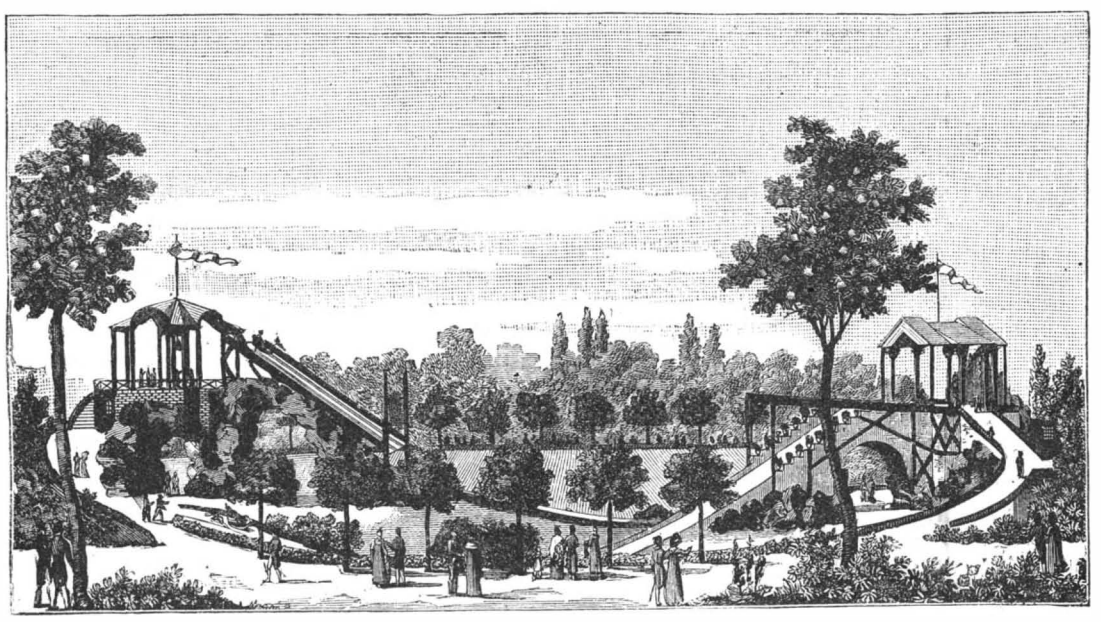

Fig. 2.—THE FALLS OF NIAGARA OF THE RUGGIERI GARDEN (1824).

* The Algonkin Indian name for a sled.

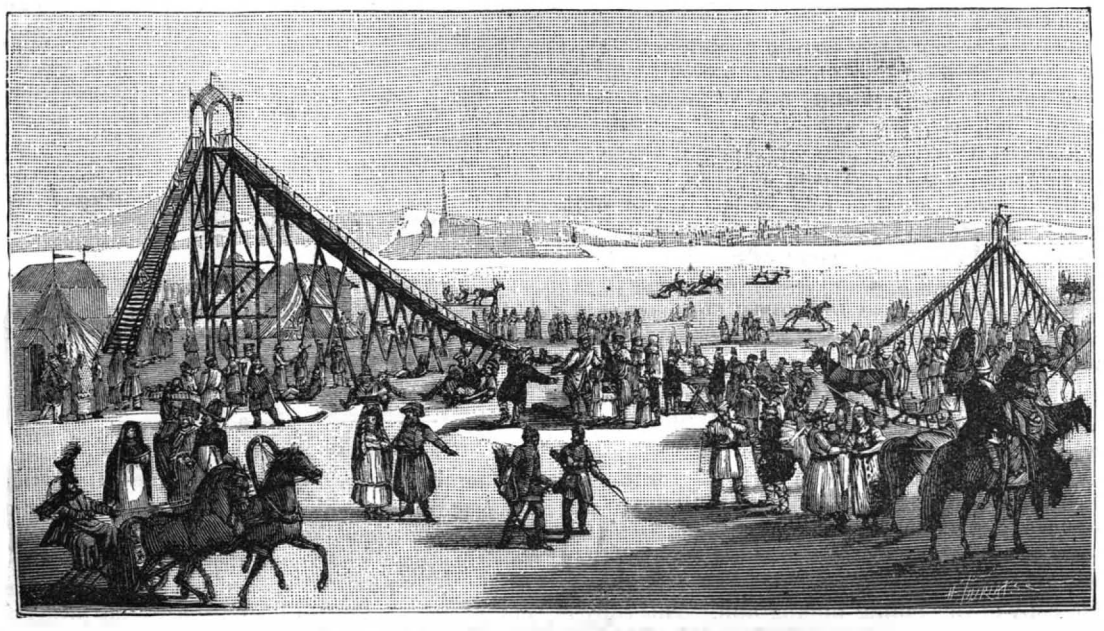

Fig. 3.—RUSSIAN MOUNTAINS IN RUSSIA.

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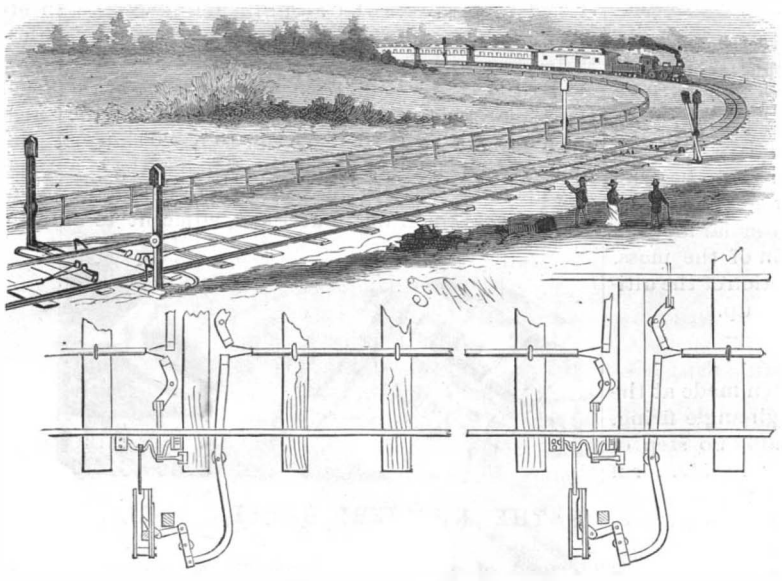
chronometer. This style of Russian mountain differs from those that have hitherto been operated. It is due to an English builder, Mr. Thompson, who has put up numerous specimens in various countries.—*La Nature.*

AN IMPROVED BLOCK SIGNAL.

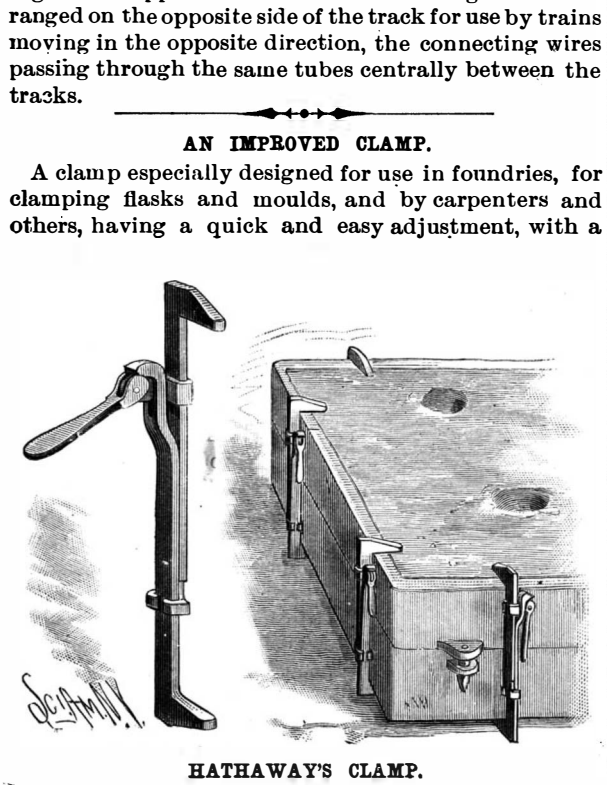
A block signal system, so arranged that a train entering a section of track will set a signal at the end of the section toward which it is moving to "danger," and set to "safety" a similar signal, by the same movement, on the section it is leaving, has been patented by Mr. George W. Peterson, of Leonardville, Kan., and is illustrated herewith. In connection with posts arranged at suitable distances apart at the side of the track, spring levers are mounted in alignment carrying signal disks, the posts carrying lights, and the tendency of the springs being to throw the signal disks out of line with the lights toward the track. The lower ends of the levers extend downward into cases, near the foot of the post, whence they are connected by double crank bars, links, other levers, and tripping bars, with wires extending through tubes secured to the ties midway between the tracks, the posts and signal disk levers at each end of a block or section being thus connected together. The engine is provided with an overhanging arm on its left side, mounted in such position that it will strike against and depress the tripping bar connected with this signal disk lever moving mechanism, thus closing or setting to safety the signal for the section of track it is passing from, and setting to danger the signal at the farther end of the block the train is just entering, to warn the engineer of a train approaching in the opposite direction. Similar signals are arranged on the opposite side of the track for use by trains moving in the opposite direction, the connecting wires passing through the same tubes centrally between the tracks.



PETERSON'S BLOCK SIGNAL.

AN IMPROVED CLAMP.

A clamp especially designed for use in foundries, for clamping flasks and moulds, and by carpenters and others, having a quick and easy adjustment, with a secure fastening, is illustrated herewith, and has been patented by Mr. Henry E. Hathaway, of Merrill, Wis. One of the bars has a guiding clasp to embrace the edges of and slide freely on the other bar, which has at its inner end a slotted offset portion with outwardly projecting lug and inclined bearing face. A stud on an independent clasp embracing the other arm of the clamp passes through the slot, and on this stud is pivoted a cam which operates against the inclined bearing face of the lug at the extremity of the first arm. The cam has a handle for convenience in operating it, and the bars slide freely one upon the other when not set in use, the construction being such that when the jaws are adjusted or closed upon the parts to be clamped, the moving of the handle down will slightly draw the jaws of the clamps inwardly and firmly bind the bars one upon the other, preventing any longitudinal movement.



HATHAWAY'S CLAMP.

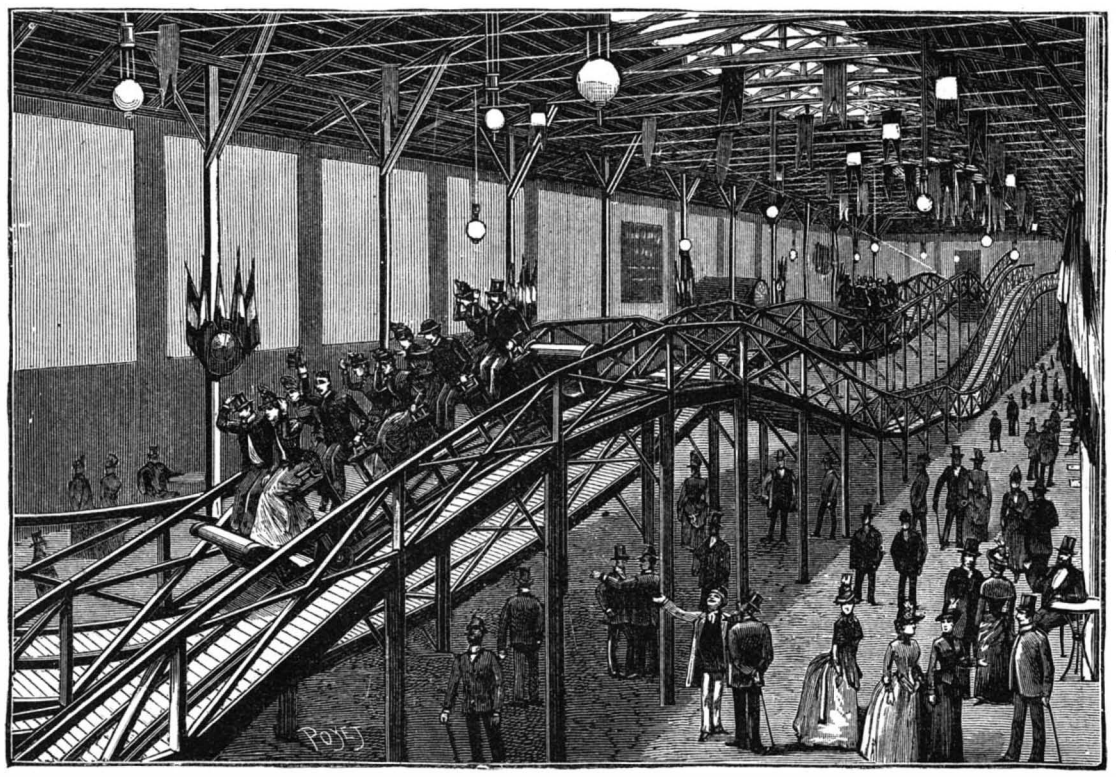


Fig. 4.—RUSSIAN MOUNTAINS OF THE BOULEVARD DES CAPUCINES (1888).

Pumping Machinery.

In the course of a paper on this subject lately read at a meeting of the Association of Birmingham Students of the Institution of Civil Engineers, by Mr. F. W. Hewett, he said that one of the first contrivances for raising water by steam pressure—or, as it was stated at the time, for raising water by fire—was Captain Thomas Savey's patent, exhibited before the Royal Society in 1699, when Sir Isaac Newton was president. The valves were all worked by hand. A most important advance was made by Newcomen, who must have been contemporary with Savey; but little was known of this gentleman except his invention. When James Watt's beam engine was invented, the conception of making the condenser apart from the steam cylinder and keeping the steam cylinder as hot as possible was the basis of its mechanical success. The energy of Bolton, his partner, soon brought this pumping engine into extensive use; and as the demand increased, so the machine developed. The supremacy of the Cornish pumping engine had remained undisputed from the moment Watt perfected it; and it had scarcely been approached for deep drainage and working against a constant head of water. The velocity of the water through the valves of ordinary pumps should not exceed 4 feet in a second at the most, and the pumps should generally work well at 50 feet per minute—bucket speed. The velocity of the water in the delivery pipes should be as consistent as possible.

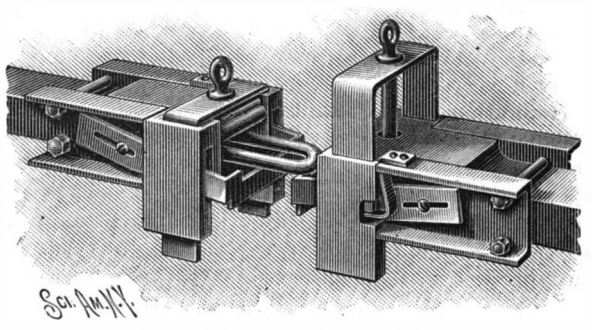
Curious Wants at Druggists' Counters.

The *National Druggist* gives the following amusing specimens as fair samples of every-day experience:

"Send me some of your essence to put people to sleep with when they cut their fingers off. I want something to take tobacco out of my mouth. Send me a baby's top to a nursing bottle. Something for a sore baby's eye. Enough ipecac to throw up a girl four years old. Enough anise seed to take the twist out of a dose of senna. Something for a woman with a bad cough and cannot cough. Something, I forget the name, but it is for a cure for a swelled woman's foot. For a man with a dry spit on him. For a woman whose appetite is loose on her."

AN IMPROVED CAR COUPLING.

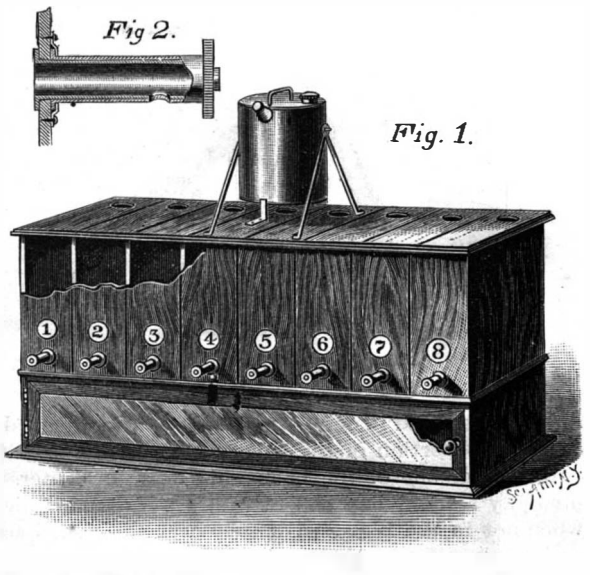
The invention illustrated herewith provides a coupling in which the link is held up and guided into the drawhead, while the coupling pin is held in position for automatic engagement therewith, and has been patented by Mr. William O. Rutledge, of Galveston, Texas. A side metallic casing is secured to the drawhead, in recessed portions in the forward part of which are guides for the depending arms of a U-shaped frame, having an aperture for the coupling pin in line with the opening in the drawhead, so that when the frame is dropped the pin will extend across the recess receiving the end of a link. The frame is held in elevated position by a spring catch on each casing, having its bent end projecting through a notch in the guide. Through slots in the front of the casing pass the legs of a U-shaped piece, whose crossbar extends over the front of the drawhead, the legs being connected to the casing by pins projecting through slots, and adapted to slide thereon, the forward portion of the legs being beveled so that the crossbar is lowered as it is pushed back by a similar piece on the opposite drawhead, thereby guiding the link into position for engagement by the coupling pin. Upon the drawheads being brought together, the parts being in position as shown in the illustration, the piece with sliding arms, which guides the link into the right hand drawhead, will be pushed back by the similar piece on the other drawhead, when a lip or projection on the casing releases the spring catch, causing the pin-carrying frame to fall, and engagement with the coupling pin is effected. This inventor has also applied for a patent for an uncoupling device.



RUTLEDGE'S CAR COUPLING.

AN IMPROVED POWDER AND SHOT CABINET.

An invention providing convenient means for handling powder and shot, in the form of a cabinet, in which a dealer may keep handily and separately the various articles generally called for, is illustrated herewith, and has been patented by Mr. Augustine La Point, of Wessington Springs, Dakota Ter. The cabinet has a lower compartment with a glass door, adapted to receive and display cartridges, gun caps, etc., and the upper compartment is divided by vertical partitions into eight or more lockers, one for each size of shot, which may be poured in through a properly capped opening at the top. The different sizes are indicated by numbers on glass sections in the front of each locker, through which also the sizes may be seen. To withdraw the shot a



LA POINT'S POWDER AND SHOT CABINET.

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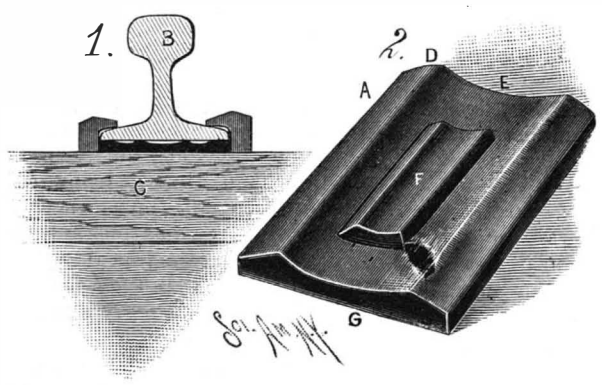
tube, as shown in Fig. 2, is inserted in the bottom of and projects from the front of each locker, the tube having its outer end sealed and an aperture in its under side, a cylindrical casing being slid over the tube and turning readily thereon, such casing having at its outer end an aperture corresponding with the aperture in the tube. This casing is revolved by a disk with milled periphery, and permits the shot to escape when it is turned so that the apertures are in register. A powder can is pivoted between brackets on the top of the case, the can having an aperture with screw cap for admitting the powder, and a spout from which the powder is poured as the can is tilted.

AN IMPROVED RAILWAY RAIL PAD.

A device intended to lessen the noise made by railway trains, prolong the life of the rolling stock, and reduce the wear upon bridges and trestle work, is illustrated herewith, and has been patented by Messrs. H. J. Fackenthall and Lewis Wallace, of No. 761 North Thirty-ninth Street, Philadelphia, Pa. It consists of an elastic pad, A, preferably of rubber, of the width of the rail, B, at its base, and of a length equal to the width of the tie, C. Its upper longitudinal edges, D, are beveled, and the portion intervening is concaved in cross section, as shown at E, while it has a central rib, F, the highest points of which are in alignment with the outer longitudinal edges of the pad. This pad not only forms a

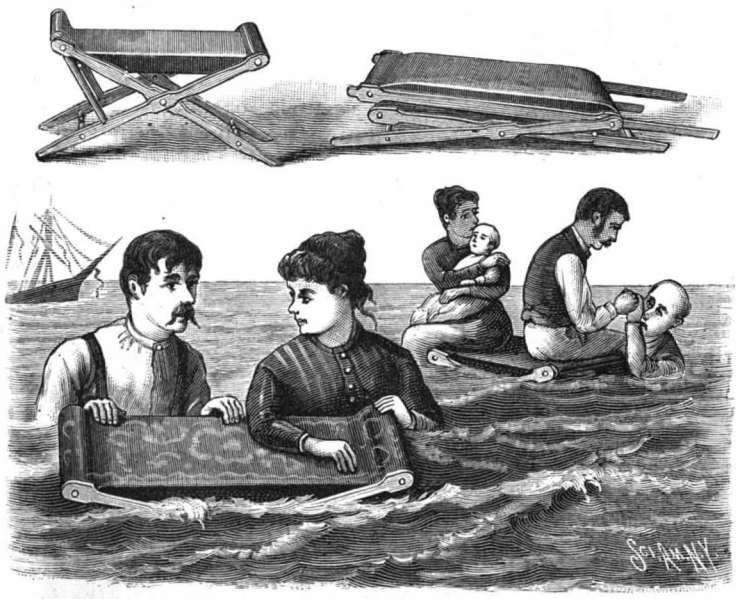


FACKENTHALL & WALLACE'S RAIL PAD.

cushion to give elasticity to the rail, but serves to keep it in constant close engagement with the spikes, and when the latter become loose, and are again driven, the surface of the pad becomes more straightened, becoming perfectly flat by successive readjustments of the spikes.

AN IMPROVED LIFE-PRESERVING CHAIR.

A chair which, when unfolded, can be used on a vessel or steamer as an ordinary chair, but which, in case of accident, can be folded up and employed as a life preserver, being so constructed that it will support several persons in the water, is illustrated herewith, and has been patented by Mr. James A. Ashworth, of Yonkers, N. Y. The back and seat of the chair are formed of a single piece, preferably of water-proof material, in one or more pockets of which a buoyant substance, usually cork, is confined and secured. This water-proof cover is secured around the top cross bar of the frame of the chair back by a double row of stitches, and buoyant material is secured within this covering to the lower end of the back of the chair frame, where rows of stitches are placed each side of the cross bar and around the hinge portion sufficiently to give great strength with flexibility, the covering being carried forward and firmly stitched around the forward cross bar of the seat, and similar buoyant material being secured in one or more pockets in the body of the seat portion of the covering material. To the outer side of one of the back rails, near its center, is pivotally secured one end of a strap or band, which when not in use is passed loosely over the chair back and hooked by a loop or ring over a button on the other back rail. In case of accident the chair is made into a life preserver by folding the cork back forward over the cork seat, the hinge spaces at the rear end of the seat permitting this, and the chair is then firmly secured in its folded position by means of the strap attached to one of its back rails, these rails and the legs affording a convenient grasp or hold for persons in the water. These chairs can also be constructed without the back, in the form of a folding stool, as shown in one of the small views.



ASHWORTH'S LIFE-PRESERVING CHAIR.

For further information relative to this invention address the inventor, or Mr. George Ashworth, 19 Smith Street, Danbury, Conn.

Progress of Electrical Science.

Professor Elisha Gray, in a lecture preceding a series of interesting electrical experiments given at Evaston, on the 10th of May, said, among other things too good to omit, but which for lack of room must be deferred, that those of us who are just crossing the meridian of life can well remember the first telegraph wire that was strung in this country. To-day it is difficult to find a corner of the earth so remote as to be out of sight of one. You will find them even in the bottom of the seas and oceans. The last twenty years have seen more advance in the science of electricity than all the 6,000 historic years preceding. More is discovered in one day now than in a thousand years of the middle ages, so that literally, "a day is a thousand years." We put it to all sorts of uses. We make it carry our messages, drive our engine, ring our door bell, and scare the burglar.

We take it as a medicine, light our gas, see by it, hear from it, talk with it, and now we are beginning to teach it to write. If Job lived in this age, and the question were put to him as of old, "Canst thou send lightnings, that they may go and say unto thee, 'Here we are'?" he could say, "Yes;" and they can be made to say it in the vernacular. A friend of mine says in verse:

Time was when one must hold his ear
Close to a whispering voice to hear—
Like deaf men, nigh and nigher;
But now from town to town he talks,
And puts his nose into a box
And whispers through a wire.

In olden times along the street
A glimmering lantern led our feet
When on a midnight stroll;
But now we snatch, when night comes nigh,
A piece of lightning from the sky
And stick it on a pole.

The question naturally arises in contemplating this subject, "What is it?" I can imagine the last man on the last day asking this same question, "*What is it?*" At one time, not long ago, it was supposed to be a fluid, by some two fluids, a positive and a negative. But in this day there are few who do not believe it to be simply a mode of motion; not matter, but a condition of matter; and not a mechanical, but a molecular motion. By mechanical motion is meant a motion of the mass, and by molecular motion is meant a motion of the ultimate particles of which the mass is made up.

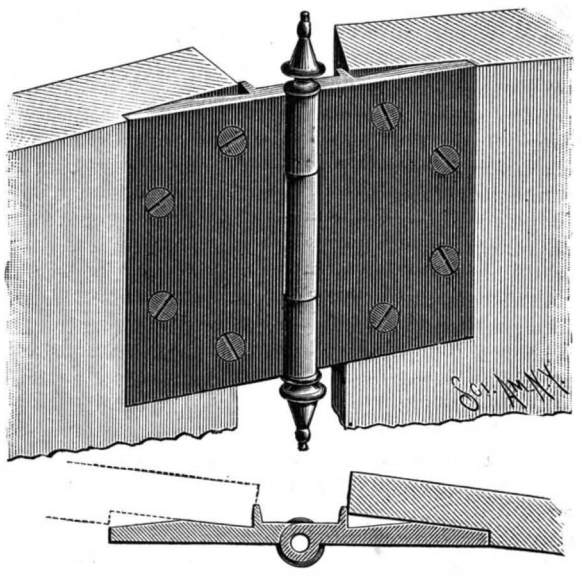
Fifteen Mile Guns.

Some important experiments have been made at the Shoeburyness school of gunnery in high-angle firing. A London correspondent writes: Probably no step of recent years is likely to lead to greater results, for if the experiment should be repeated with the same success, it is undeniable that war ships will have to be as fully protected on their decks as they now are on their broadsides. The experiments were made with the 9-inch or 23-centimeter gun used as a howitzer. An elevation of 37 degrees was given and battering charges were used with Palliser shells. Out of four shots three fell within a space of 500 feet by 80 feet, representing the deck of a first-class ironclad, and the range attained was 12 miles! Now, if it be really possible, three times out of four, or for that matter once out of four times, to throw a 9-inch shell upon the deck of a ship in midchannel between Dover and Calais, another proof will have been given that in the tedious duel between gun and armor the gun has much the best of it. What is very important, too, is that the heavy charges and the high angle did not strain either gun or carriage in the least, and one of the officers present has said that he believed the gun would stand 45 degrees of elevation without injury, while with 42 degrees a range of 15 miles would be secured. Now, at 15 miles, a ship is "hull down," so it comes to this, that we can throw a 9-inch shell on to the deck of a ship before we can see it! Surely this is the most marvelous thing yet attempted in gunnery, which of later years has been so fruitful in surprises.—*A. & N. Register.*

WE are indebted to Professor A. N. Talbot, of Champaign, Ill., for a copy of the proceedings of the third annual meeting of the Illinois Society of Engineers and Surveyors.

AN IMPROVED HINGE.

A hinge by the use of which a door or shutter or similar piece of work may be thrown in or out to compensate for shrinkage or warpage, without inserting wedges, is illustrated herewith, and has been patented by Mr. Charles H. Beer, of No. 317 East 125th Street, New York City. The under or engaging faces of the hinge have a longitudinal shoulder, with inclined planes emanating from the center and inclined therefrom. Four or more screw apertures are provided in each leaf, and when four are employed, two of them are in the outer inclined plane and two at each side of

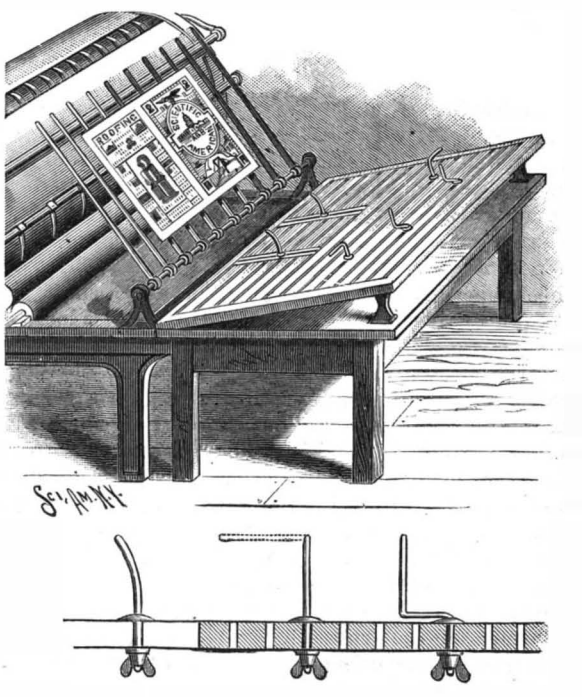


BEER'S HINGE.

the center in the other inclined plane, so that by loosening one set of screws, when the hinge is screwed in position, and tightening the other set, either inclined plane may be brought into positive engagement with the door or frame, which may be thus thrown out or carried inward as the occasion may demand.

IMPROVED RECEIVING-TABLE FOR PRINTING PRESSES.

A receiving-table for cylinder printing presses, designed to facilitate the accurate piling of the sheets without the use of the ordinary form of jogger, is illustrated herewith, and has been patented by Mr. Frank W. Baltes, of Portland, Ore. Upon a table of the usual construction is set at a slight angle a frame in which are mounted strips so placed as to leave slots or openings between them of about three-sixteenths of an inch in width. The strips furthest from the press run entirely across the frame, but those adjacent to the opposite side of the frame are divided into three sections, being divided by other strips to form slots or openings extending from the inner edge toward the center of the frame. In these slots are mounted backwardly curved guiding fingers, other sets of differently formed fingers being mounted at the sides and toward the outer edge of the frame, as shown in the illustration, to be adjusted as desired on the frame according to the size of the sheet being printed. The outwardly extending arms of the side fingers may be adjusted, as shown, to serve as stops for the fly, or turned to rest in lines parallel with the fly fingers. As the fly descends, the inner edge of the sheet will strike against the backwardly curved faces of the fingers nearest the press, the sheet then coming to place between these fingers and the other fingers on the frame.



BALTES' RECEIVING-TABLE FOR CYLINDER PRESSES.

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THE LIDGERWOOD MANUFACTURING CO.'S HOISTING ENGINES AND BOILERS—THE GORTON HEATER.

In the illustrations on our first page we have endeavored to bring before the mind a correct idea of the plant, and the methods of prosecuting the work, in one of the largest and best equipped modern establishments especially devoted to the manufacture of hoisting engines and boilers.

The works of the Lidgerwood Manufacturing Company, which we take as a type, are near the Atlantic Basin, at the foot of Dikeman Street, Brooklyn. The main machine shop is 75 by 200 feet in size, and, with its gallery and two wings, affords a floor space of 28,750 square feet. The erecting shop covers a ground space of 50 by 228 feet, and with its gallery affords 17,500 square feet of floor room. The boiler shop is 50 by 290 feet, the blacksmith shop 45 by 90 feet, the Gorton heater shop 25 by 100 feet, and the storage shop 45 by 100 feet. Power is supplied by two engines, connected, but which may be readily disconnected, when either one will afford sufficient power for the entire establishment. All of the departments are completely fitted out with powerful traveling cranes, and the equipment in lathes and boring and turning machines of the latest patterns is designed to more than meet every possible demand. In every branch of the business, attention has been constantly directed to securing uniformity as well as perfection of work through the employment of machinery; and in milling machines there are several of novel construction, especially designed for the work of the company, who have made something of an innovation on ordinary machine practice in the extent to which they carry the work of machine milling.

The engines made by the company present too great a variety for us to mention them all in detail, but their single and double cylinder friction drum portable hoisting engines, with the latest improvements, constitute a representative type of a large part of their business. In the latest patterns of these engines, embodying the results of many years' experience, especial care has been taken to have them simple in design and construction, and well proportioned throughout in accordance with their cylinder power. The cylinders are of extra quality charcoal iron, the steam and exhaust ports being of ample size and designed for high speed, with D slide valve, the valve and valve seat having a scraped fit. The valve and piston rods are of steel, and the crosshead is of the locomotive hanging type, fitted with composition gibs having extra large wearing surfaces and easily adjusted to take up wear. The connecting rod is of best Ulster iron, and the drum and crank shafts are of the best quality of wrought iron, and calculated to be of ample strength for any possible requirement. The crank wheel is counterbalanced, and is forced on the crank shaft by a special press. The bearings are large, and fitted with anti-friction metal. A winch head is placed on the outer end of the drum shaft, and a band fly wheel on the crank shaft, for pumping, sawing, etc.

The friction drums of these engines have many improvements for which patents are held and owned by the company. The frictional hold is effected by the engagement of segments of hard wood, bolted on the inner surface of a spur wheel, to make a hollow inverted double cone, with corresponding cone-shaped flanges at one end of the drum. The spur wheel is actuated by a pinion on the crank shaft, and is ordinarily in constant motion. The drum is loose on its shaft, on which it has long bearings, and is free to revolve without sensible resistance, but the cone-shaped flange at one end of the drum is thrown into friction contact with the wood-lined spur wheel by a slight lateral motion of the drum, effected by means of a lever, screw, pin, cross key, and collar, and released by means of a spiral spring interposed between the friction surfaces. The great power afforded by this construction is obvious, being such that a very slight pressure will hold the drum against any load the engine can hoist. The end thrust caused by the lateral movement of the drum shaft is taken up by a thrust bearing and screw collar. The friction wood is secured to the inner surface of the spur wheel by bolts and nuts in such way that it can be always kept tight without trouble.

The drums are extremely durable, having been in constant use for years without requiring renewal, and the entire machine leaves nothing to desire in the quickness of its operation and the ease with which it can be managed. This is particularly exemplified in pile driving, when compared with the work done by any clutch and brake engine. The rope is made fast to the hammer, and passes up over the sheave and down around the drum. When the hammer is raised to the desired height, the drum is released, the rope then overhauling the freely revolving drum as the hammer falls, it being entirely within the discretion of the operator, without a moment's delay, to give either short, quick blows, or long and heavy ones, from the entire height of the pile-driving frame. This class of engine has now largely superseded all others for such work, hammers of twice the weight formerly employed being now commonly used, without damaging the heads or splitting the piles, and enabling the operator to give many more equally powerful blows in a minute. The quickness with which piles are driven thereby is generally very surprising to foreign workmen, and the export demand for these engines is large and growing.

In general hoisting work, as the weight is raised to the desired height, the moving of the lever and the operation of the spring loosens the hold of the friction drum, as required for ordinary lowering purposes, but foot brakes are preferably to be used therefor, as saving wear on the friction drum, and allowing the use of the engine for other purposes when a weight is to be held. These foot brakes can at any time be readily applied to an engine not having them, and some of the styles of engines are fitted with ratchets and pawls which may be thrown in and left with a load suspended.

The double cylinder engines are similar to those with single cylinders, except that they have the special feature of having no centers, the engines being connected at an angle of 90°, thus rendering them much easier to start and handle, single cylinder engines being sometimes caught on centers in handling heavy work. Double friction drum engines, with either single or double cylinders and reversible link motion, are supplied in various patterns specially adapted for quarrying, dock and bridge building, etc., whereby two derricks can be operated, or one drum can hoist a pile in pile driving, while the other handles the hammer. Double drum and double end hoisting engines are made in several varieties calculated to run at different speeds, and a style of portable hoisting and power engine is made to be housed, if desired, when, but for its larger wheels, it somewhat resembles a small dummy engine for street railway use.

Perhaps the most efficient machine ever built for mining operations is the large mining and tail rope hoisting engine made by the company, and specially adapted for double track inclines or double shafts in mines. It has double friction drum and brake and reversible link motion, both drums being loose and independent of each other, so that they may be thrown in and out of gear with the engines in motion, or one drum may be lowering while the other is hoisting, or both may be thrown into gear and the engine used as a regular reversible engine, one load being hoisted while the empty cage is being lowered. This is done with the minimum of friction and wear on the engines, and the great desirability of such independence of drum action, particularly on inclines or in mine shafts, will be at once obvious to all engineers and workmen experienced in mining operations.

Space will not admit, however, of such reference as would do justice to the great variety of engines made by the company. Work for which they have a regular demand they keep always in stock, their manufacture being carried on according to the duplicate part system, from complete sets of gauges and templets, which insures absolute accuracy. Instead, therefore, of building each engine separately, they are always ready, on receipt of an order, to send the parts to the erecting shop and set up the particular engine called for, after which the engine is thoroughly tested, being set up and run with steam on before being shipped. This system not only reduces the cost of production, while necessarily calling for the highest degree of accuracy, but it enables a user of these engines to obtain at any time, without delay, any special part of an engine which may give out, from wear or accident. The standard character of these engines has been recognized by different departments of the United States government, in their specifications for contractors, in which, in many cases, it is stipulated that engines furnished shall be equal to those of the Lidgerwood company. They have been on the market now some eight years, and there are over 4,500 of them in use, being employed in every part of the world.

The manufacture of boilers specially adapted for these various engines constitutes an important portion of the business of the company, as they make also marine boilers of all kinds, horizontal return tubular boilers, stationary and portable locomotive boilers, upright tubular boilers, and any kind of work in this class which may be called for. The shells, unless otherwise ordered, are made of CH No. 1 shell iron, of 50,000 lb. tensile strength, and the tube heads of the best flange iron, all of brands tested and known to be reliable, steel being used in place of iron when ordered. All of the boilers are hydraulic riveted, every rivet being subjected to exactly thirty-five tons pressure. The bracing and staying is of ample strength to allow a large factor of safety. The edges of sheets are planed off true and smooth, and the seams are thoroughly calked inside and outside. The tube heads are flanged on formers specially made for the purpose, the tube holes being drilled to size and the tubes carefully fitted, being usually driven in with a maul and then expanded. The fittings are complete, strong, and substantial, of good design, being made by special tools. The tests include a practical steam test to the guaranteed working pressure of 100 pounds, and a hydrostatic test to a pressure of 160 pounds, and every boiler must be found perfect under such pressure before being sent out.

As relating to a branch house of the Lidgerwood Manufacturing Company, we illustrate in one of our first page views the large Gorton heater shop of the Gorton & Lidgerwood Company. These heaters have been many years before the public, and have had a large sale, which, with the extensive facilities of the company for their manufacture, afford the best evidence of their high character. These house-heating boilers are for private residences, schools, public buildings, etc., and are unlike any other boiler for such purposes. They combine improvements attained through many years' practical experience in satisfying the demands of a large trade. They are side feed boilers, built on the plan of an upright tubular boiler, and are self-feeding as well as surface burning, being adapted for use either way. The coal reservoir is between the lower outside surface of the boiler and the water leg, and the tubes are directly above the fire, the heat passing up through them to the top and thence down on the outside between the boiler and jacket to the smoke pipe in the back. The boiler is designed to generate steam in the most economical and effective manner, the tubes being placed as thickly as will admit of proper circulation, and its evaporative efficiency is calculated as fully equal to that of the return tubular boiler. The coal reservoir is designed to hold sufficient coal to last from twelve to twenty-four hours without refilling, and the grate is low in the center, so that the coal will gradually feed down from the outer surface as it is needed, and distribute itself at a uniform depth over the surface of the grate, the fire being always directly under the tubes. The grate is of the shaking and dumping type, its outer or main part resting on ball bearings, so that it can be easily shaken, and the center part being independent and arranged to swing to one side for removing clinkers or dumping the fire. This boiler can be used with efficiency and economy for circulating hot water, as well as for making steam.

The general offices and salesrooms of the company are at No. 96 Liberty Street, New York, and No. 159 Friend Street, Boston.

Water as a Constituent of Organic Substances.

Water, says Dr. Whitelaw, forms three-fourths of the weight of living animals and plants, and covers about three-fourths of the earth's surface. Professor Chaussier dried the body of a man in an oven, like a brick in a kiln, and after desiccation the body weighed only twelve pounds. Rather more than a pound of water is exhaled daily by the breath, about 1¾ pounds by the skin, and 2¾ pounds by the kidneys, making the daily emissions of water by the body about 5½ pounds, or not quite 3 quarts. The following is the percentage of water in some well known articles:

Wheat	15	Mangel wurzel	85
Barley	15	Cabbage (leaves)	92
Oats	16	Cabbage (stem)	84
Rye	12	Mushroom	96
Rice	13	Fungi	86 to 95
Beans (field)	15	Potato	75
Beans (kidney)	23	Watermelon	94
Peas	14	Cucumber	96
Turnips	88	Vinegar plant	95
Carrots	83	Wheat flour	13 to 16
Rye flour	14	Cocoa	5
Barley flour	14	Manna	10
Maize flour	13	Figs	21
Indian corn flour	14	Plums	75
Oatmeal	14	Apples	80
Wheat bread	44 to 48	Gooseberries	80
Rye bread	44 to 49	Peaches	75
Cane sugar	5	Egg, entire	74
Linseed cake	10	Milk	87
Flesh	77	Blood	79 to 83
Skin	58	Gastric juice	97
Bones, variable	7 to 20	Trout	80
Beef	74	Pigeon	79
Veal	75	Cheese	40
Mutton	71	Hair, wool, horn	9 to 11
Haddock	82	Brandy	56
Sole	79	Whisky	47
Tea	5	Rum	30
Coffee	12	Beer	90

A New Frictional Machine.

At a recent meeting of the Liverpool Chemists' Association Dr. Symes exhibited and described Mr. Tudsbury's new double cylinder electric machine for the generation of frictional electricity. It is a modification of the Wimshurst influence machine. Wimshurst's machine, as our readers know, consists of two plates of glass, the surfaces of which are brought near together, but do not touch each other. They are caused to revolve rapidly in opposite directions. The modified machine of Mr. Tudsbury is made of ebonite, in the form of two cylinders, very much in appearance like two sieves revolving one inside the other, the sectors being placed transversely across the hoop. This machine, the smaller patterns of which would prove admirably adapted for medical use, is also fitted with a new double high tension discharge, whereby the length of spark obtainable is considerably increased. Glass machines all give positive electricity. The new ebonite apparatus will yield negative electricity in the same manner.

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Natural Gas in China.

The following abstract of an account given by Baron Von Richtofen of natural gas wells in China is given in the United States consular reports by Charles Denby, United States consul at Peking. These wells are found in Sz'chwan, near a town called Tsz-lin-tsing. In an area of twenty-seven li (9 miles) diameter salt wells are found. To make a well the Chinese use a long and elastic bamboo pole, supported in the middle by a cross piece, a rope made by coupling the ends of long (not twisted) slices of bamboo, and an iron instrument which weighs 120 catties (catty = 1⅓ lb.) The rope is fastened on the thin end of the pole, and the iron on the end of the rope. A slight up and down motion of the thick end of the pole makes the iron hop and bore a vertical hole with its broad, sharpened edge. The ground to be perforated consists chiefly of sandstone and clay. When a portion of the rock is mashed, clear water is poured into the hole, a long bamboo tube with a valve in the bottom is lowered, and the turbid water raised to the top. Pipes of cypress wood are rammed in to protect the sides of the bored hole and to prevent the water contained in the surrounding ground from getting access to the well; the pipes are attached to each other at the ends with nails, hemp, and tung oil. The inner width of the pipes is about 5 inches. As the work proceeds the pipes are rammed deeper, and a new one attached on the top; the rope, too, is made longer. At a depth varying from 70 to 100 chang (700 to 1,000 feet) the brine is struck, and the well is fit for use. The brine is raised to the top through long bamboo tubes and bamboo ropes, as described, by means of a horse whim, and then carried to large pans for evaporation, or led to them through bamboo pipes.

Besides these wells there are others, which are bored to the depth of from 1,800 to 2,000 feet. At that distance below the surface petroleum is struck. Immediately on reaching it an inflammatory gas escapes with great violence. Work is now stopped, and a wooden cap fastened over the mouth of the pit, perforated by several rows of round holes. In each of them a bamboo pipe is inserted, and through these the gas is led under the evaporation pans. The pipes ramify, and on each end a tapering mouthpiece, terminating in a small aperture, is attached. The gas is then used for evaporating the brine.

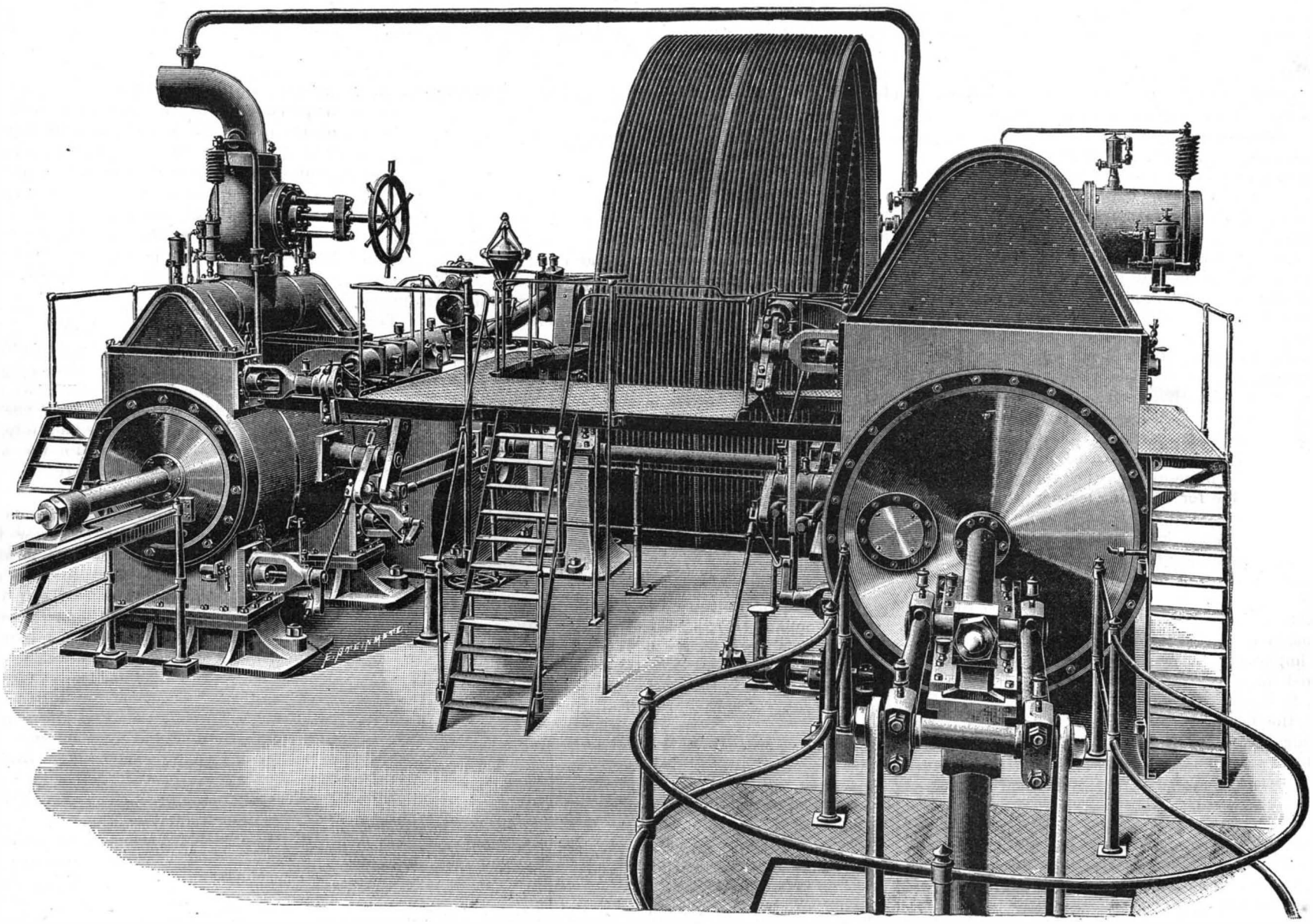
The enterprising spirit which induced the Chinese to examine the ground at so great a depth is said to have had its origin in the drying up of a brine pit. The proprietor was in hopes of meeting brine at a greater depth, but found instead the gas.

When the country was infested with rebels during the Taiping rebellion, they removed the cap from one of the gas pits and set fire to it. Since that time, or at least up to the time that Baron Richtofen wrote, a long column of fire rose from that pit, and it is considered nearly impossible to stop the flame.

The gas pits and brine pits are owned separately by corporations. The owners are subjected to the control of the government. The government monopoly is in the hands of the "taotai," who resides at the place. The salt works of Tsz-lin-tsing yield considerable revenue to the government, and have besides enriched numerous proprietors, and give occupation to a numerous population. The number of "fire pits" is twenty-four, and the salt pits are innumerable. Some of them do not enjoy the advantages of gas. The brine is evaporated with grass and wood.

2,500 H. P. CORLISS ENGINE.

As illustrative of the progress of the Corliss system of engines we give an engraving, from *Engineering*, showing a fine pair of compound Corliss engines lately constructed by Messrs. Douglas & Grant, of Kirkcaldy, for the Mazayon Spinning and Manufacturing Company. The cylinders are 40 in. and 70 in. in diameter respectively, and have a stroke of 6 ft. The power, which amounts to 2,500 indicated horse power, is transmitted to the various lines of shafting in the mills by ropes running off a fly wheel 30 ft. in diameter by 8 ft. 6 in. wide, and grooved for 38 ropes. This wheel weighs about 110 tons, and runs at 60 revolutions per minute, giving a speed to the ropes of considerably over a mile a minute. The crankshaft, made of Whitworth's fluid compressed steel, is 25 in. in diameter in the body and 20 in. in the bearings. The steam pressure will be 100 lb. per square inch.



IMPROVED CORLISS ENGINE OF 2,500 H. P.

Right to the Use of Water.

The *Legal Adviser*, published at Chicago, gives its readers some information respecting water rights, which has been a source of great trouble and much litigation between neighbor farmers.

It is a general principle, says the writer, that every owner of land upon a natural stream of water has a right to use the water for any reasonable purpose not inconsistent with a similar right in the owners of the land above, below, and opposite to him. He may take the water to supply his dwelling, to irrigate his land, or to quench the thirst of his cattle; to use it for manufacturing purposes, such as the supplying of steam boilers or the running of water wheels or other hydraulic works, so long as such use does not sensibly and injuriously affect its volume. But this is a mere privilege running with the land, not a property in the water itself.

Where the stream is small and does not supply water more than sufficient to answer the wants of the different proprietors living on the stream, none of the proprietors can use the water for either irrigation or manufacturing, but for domestic purposes and watering stock, one proprietor will be justified in consuming all the water.

Twenty years' use adverse to the right of another, will give the person so using the stream the right to continue the use, regardless of the other's rights.

And as to the division of water, every farmer who owns land situated upon a stream has the following rights:

1st. To the natural flow of the stream.

2d. That it shall continue to run in its accustomed channels.

3d. That it shall flow upon his land in its usual quantity, natural place, and usual height.

4th. That it shall flow off his land upon the land of his neighbor below, in accustomed place and at its usual level.

These rights he has as an incident to the property in his land, and he cannot be deprived of it by grant or description.

If any farmer shall make any change in the natural flow of a stream to the material injury of any other owner situated upon it, or by any interference shall prevent the stream from flowing as it was wont to flow, he is responsible for the damage he may occasion. These rights are subject to the privilege of each one of the farmers to make a reasonable use of the water upon his own land, while it is passing along the same. It matters not what the source of the water may be, whether it be backwater or the flowage of the same, or the water of another stream. Still, a division of a stream may be made by the farmer, if it be returned to its natural channel before it leaves his premises.

The United States Commissioner for Brussels.

The Hon. John Bigelow was recently appointed United States Commissioner to the Brussels exposition, and has sailed for Europe to take charge of the American exhibits at the Belgian capital and see that they are properly placed and classified. The exposition will open on June 2, and close in November. The buildings and grounds cover 100 acres, and are said to exceed in size and grandeur those of any previous exposition. Enormous temporary structures of brick and iron and a large permanent building of stone have been erected. A large portion of the exhibits are now in place. Owing to the delay of Congress in appropriating $30,000 to pay for the supervision and care of the exhibits from this country, fewer manufacturers have sent articles than was expected. Every prominent industry will be represented, however.

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GEORGE H. CORLISS.

George H. Corliss, the inventor of the improvements in the steam engine that bears his name, and has won for him an enviable fame the wide world around, was born in Easton, N. Y., on June 2, 1817. His father, a physician, removed to Greenwich, N. Y., in 1825, and the son attended school there until he was fourteen years of age.

He then found employment in a store connected with a cotton factory, as general clerk, remaining in this position for several years. His desire for a liberal education and his thirst for knowledge became so earnest and engrossing that he resigned his situation and entered an academy at Castleton, Vt., where he faithfully pursued his studies for three years.

His academic days being completed, his next move was to establish a country store in Greenwich. The venture was more than successful, but young Corliss, weary of the monotony and limited sphere of his business, developed aspirations for a wider field of labor. During the later years of his residence in Greenwich, there were intimations of the inventive genius and mechanical tastes that were to be the distinguishing features of his brilliant career. He was eighteen years old before he had ever seen the inside of a machine shop.

The hour came, however, for action in the field for which he was especially adapted, and he was not found wanting. Greenwich is divided into two sections by the Battenkill, and the only bridge that united the two parts of the town was carried away by a spring freshet. The result was a serious inconvenience to the town. The prominent citizens decided, at a meeting held for the purpose, that a temporary bridge was impracticable, and adopted a plan for building a scow to ferry passengers and teams over the stream. Young Corliss, in spite of strong opposition, devised a plan for a bridge, raised $55, the necessary funds, by subscription, and, with the help of volunteer farmers and workingmen, completed a bridge in ten days that did excellent service for six months.

Another occurrence showed more plainly the special field of Mr. Corliss' inventive power. Boots and shoes were a prominent item of merchandise in his country store. He became impressed with the idea that machinery might be properly used in their manufacture. The result was the construction of a machine for stitching leather; this invention antedated that of the Howe sewing machine. While improving and developing this machine, he commenced the manufacture of the tools required in its construction, and he was thus introduced into the machine shop, and the steam engine business was the result.

An important epoch in Mr. Corliss' life occurred in 1844. He removed to Providence, R. I., and became identified with, and finally the head of, the firm of Corliss, Nightingale & Co., and in 1848 he completed and started a steam engine, embodying the essential features of the improvement he had designed. In the Corliss engine the governor is connected with the cut-off, instead of the throttle valve. The governor does no work, but simply indicates to the valves the work to be done, thus by one feat of engineering skill obtaining two results—uniformity of motion and economy of fuel. The improvement was so great and so practical that the Corliss engine has obtained a unique position of its own.

The Corliss Steam Engine Company was incorporated in 1856, with Mr. Corliss for president. He was his own architect and engineer in designing and constructing the buildings for the factory. The grounds extend over more than nine acres, the buildings covering half the space, and the rest being devoted to lawns, drives, and ornamental shade trees.

In 1872, Mr. Corliss was appointed commissioner for Rhode Island to the international exposition at Philadelphia, and was chosen as one of the executive committee of seven, to whom the preliminary work was intrusted. In 1875, he submitted plans for the construction of a grand central steam engine of 1,400 horse power, proposing not only to utilize it as the motive power for all the machinery to be exhibited, but also to make it an ornament to this department of the exposition. After much delay and vexatious opposition, the plan was adopted. Every visitor to the Centennial bore witness to the success of the experiment in the perfect adaptation to the requirements demanded, and also to the artistic elegance of its construction. The result was produced by the untiring energy and determination as well as the engineering skill of Mr. Corliss in devoting his personal attention to the construction of the engine, and also to the fact that he contributed $100,000 to the work from his own private funds over and above the aid furnished by the commission. Many wonderful and beautiful sights and scenes at the exposition will be forgotten, but long as life endures will memory bring back the thrilling moment when the Corliss Centennial engine, like a being endowed with life and touched by a magic wand, commenced its movement for the day, and did its work with an almost human intelligence.

Mr. Corliss gave his busy brain no rest. Some of his later inventions are a machine for cutting the cogs of bevel wheels, an improved boiler with condensing apparatus for marine engines and pumping engines for water works.

The last three years of Mr. Corliss' life were occupied with the invention and construction of special machinery to be used in the manufacture of steam engines, with the firm conviction that he would thus be enabled to lessen the cost to the purchaser. In this plan several of the mechanical operations on each piece of machinery are carried on and completed with one adjustment and one set of tools. In order to make the plan successful, a number of pieces of the same shape must be manufactured. The inventor's purpose was to extend his business sufficiently to be able to keep special machines busy all the time on every detail, and to accomplish this aim he perfected an organization by which three large engines can be turned out every ten hours, complete in all their intricate parts.

His plans were at length completed to his entire satisfaction, the reorganization of his working force was adapted to the new methods of handling material from the time it entered the works until it was finished, and the special tools were ready to commence their task at the master's call. But he was not destined to behold the active operation of his latest invention—the triumph of his art. In the midst of his honorable career, in his golden prime, he passed away on February 21, 1888, in his 71st year, having lived a little beyond the threescore and ten years allotted to man.

GEORGE H. CORLISS.

Mr. Corliss received many proofs of the high appreciation in which his important inventions were held. He won the highest competitive prize at the Paris Exposition of 1867. The Rumford medals were awarded to him in 1870 by the American Academy of Arts and Sciences. He received the Grand Diploma of Honor from the Vienna Exposition of 1873, although not an exhibitor. In 1878 the Institute of France gave him the Montyon prize, the highest honor for mechanical achievement. In 1886 the King of Belgium made him an officer of the Order of Leopold.

On the other hand, he had the usual experience of inventors. Obstacles beset his path. There were conflicting interests, competition, deeply rooted prejudices to overcome; vexatious lawsuits were forced upon him, continuing for fifteen years, and costing him $100,000, but ending in a full vindication of his claims.

Strength and tenderness were the distinguishing features of Mr. Corliss' character. The strength was apparent to all, the tenderness found its fullest expression in domestic life. He sought with conscientious purpose to find out what was right, and, when his mind was made up, held to the courage of his convictions, swerving neither to the right nor left. As a matter of principle, he threatened to stop the running of the Centennial engine, if the exposition were open on Sunday, and he carried his point. He refused to countenance corruption and bribery in accomplishing his purposes. He made large contracts to build engines for the government during the civil war, and waited seven years for his pay, with a heavy loss of interest, rather than condescend to give retainers for the influence of Washington lobbyists.

The sunny side of Mr. Corliss' character found its highest expression in his home, the beautiful home in whose structure, convenience, and ornamentation every resource of his inventive genius found expression. Here, in the society of his wife and daughter, he passed his happiest hours. This man of strong will and stately mien was tender, chivalrous, loving, and beloved.

Mr. Corliss spared neither pains nor expense in carrying out his plans, cost scarcely entered into the calculation, if it insured success. He also contributed generously to religious and charitable institutions.

Mr. Corliss was of a modest and retiring nature, and rather avoided than sought after the public prominence he might have attained. He was, however, in the State Senate in 1868–70, and was a presidential elector in 1876. He refused the nomination of mayor and governor.

In a handsome tribute to his memory, the *London Engineering* says as follows: "By the death of George Henry Corliss, America has lost the best known engineer she has ever produced. In all the countries of the world where steam engines are employed the name of Corliss has been heard, and ranks next in familiarity to that of Watt. Indeed, it has become so much a part of our technical vocabulary that many engineers will learn with surprise that little more than a month ago the owner of it was not only alive, but was the active head of the Corliss Steam Engine Company, of Providence, R. I. Many men verging on middle age found the Corliss engine an established fact when they entered on their apprenticeship, and hence they have been disposed to class its invention with the events of ancient history, and its inventor with those who are either dead or superannuated. There could, however, be no greater mistake. Mr. Corliss has, it is true, passed away full of years and honors, but he was busy up to the last week of his life with a new Pawtucket pumping engine, and with the reorganization of the factory with which he was connected."

Fabulous Astronomy.

The stars have always had a great influence upon the imagination; so the progress of astronomy through the ages gives us a faithful image of the conquests of the human mind. We propose now to study the beginnings of astronomy, which are, as it were, the alphabet of that science.

DIVISION OF TIME.

We have watches, clocks, and calendars in profusion; but our primitive ancestors had nothing that permitted them to measure time—nothing at least but the sun and moon, which still serve our rustics to some extent, but so slightly that the bell is called upon to make known the principal divisions of the day to laborers in the fields. The course of the sun gave the succession of the days, and the lunations indicated the months. As for the seasons, at the renewal of the year, there was at first no rule that permitted of forming a calendar. Primitive man was therefore his own astronomer, and the various systems proposed in ancient times vividly reflected the temperament of their authors.

The darkness of night exerted a sort of terror on the mind of our ancestors. Just as material existence succeeds nothingness (which it is also followed by), just so does day succeed night, which is the origin of time, as winter is that of the year. The Ostiaks of the Yenisei reckon their years by snows, and the Iroquois of North America by winters. The Numidians, the Gauls of Cæsar, and the Germans of Tacitus reckoned the diurnal periods by nights. In the north principally, night had considerable importance, and the Scandinavians possessed the best connected and most poetical ideas. Day was the son of Nott, "night." The latter proceeds first, says a passage of the Edda, mounted upon his horse Rinfoxe, "ice mane." Every morning, on finishing his career, the courser sprinkles the earth with the drops of foam that fall from his bridle, and that is dew. Day follows, mounted upon Sinfoxe, "luminous mane," and his mane illuminates the air and earth. These peoples believed also that the longest night, that of the winter solstice, was the progenitor of all the others, and that the world was created during such a night. That is why it was called the "mother night." It was the greatest holiday of the year, and, at the same time, the origin of the new year. It was styled also Juul,* the present name of Christmas, which has replaced it.

The Chaldeans said that the world began at the autumnal equinox, when the night became longer than the day.

In the seventeenth century, the French tribunals were still giving orders to "put in an appearance within fourteen nights." The English say "fortnight," an abbreviation of "fourteen nights," to designate the two weeks' interval which is improperly called in French *quinze jours*.

* English, Yule.

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CURIOUS IDEAS ABOUT THE MOON.

The phases of the moon have been much remarked, and the cycle of these various appearances is short enough to favor that convenient division of time which was the ancient month, and which still serves the Israelites and Mussulmans for their calendar. When the Indians of several tribes united for some enterprise, the signal for the rendezvous was usually a full moon designated a long time in advance.

The beautiful moonlight of countries that have a usually pure atmosphere offered an invitation to games and festivities. The new moon interrupted the merry-makings, which were resumed with greater spirit when the thin silver crescent was observed after sunset. The ancient Peruvians said that the moon was dead during the three days of its invisibility. The Khasias of the northwest of India think that the sun burns it up. Several savage peoples believe that they see in the lunation a quarrel between the sun and the moon (which to them are husband and wife), passing monthly through the same phases. The moon grows from new moon to the full, then wanes; the same is the case with its domination; finally, the sun triumphs and swallows its adversary, whose head it spits into the heavens. The ancient Slavonians believed that the moon, having been untrue to her husband, with the beautiful Venus, was condemned to wander in the heavens. The Dakota Indians think that the moon at its waning is eaten by little mice. The Polynesians believe that it is devoured by the spirits of the dead. The Hottentots say that it wanes when, suffering from a headache, it puts its hand to its forehead and hides the latter from our view. The Eskimos imagine that the moon, harassed by fatigue and hunger after finishing its journey, retires for a moment to take rest and food. Its apparent corpulence after its reappearance shows with what avidity it has fed.

The spots on the moon have attracted attention and stirred the imagination in all ages. There is probably no country in which an imaginary picture has not been seen in the disk of our satellite; and yet, among the various figures that are thought to be seen in the moon, two principal types seem to prevail, according to a certain geographical distribution. In Eastern Asia, the common vision is that of a hare or rabbit. The Chinese imagine that they see a rabbit seated upon its haunches before a mortar and pounding rice, after the manner of the country. The Hindoos see a hare or a squirrel, and they call the moon the hare or squirrel carrier. The Siamese see the figure of a hare in the moon; although some distinguish therein a man and woman cultivating their field.

[Albertus Magnus thought that the form of the spots represented a lion with his tail toward the east and his head to the west; others have thought it to be much more like a fox.]

Among many of the Indian tribes of North America, the hare is the symbol of the moon, as the jaguar is that of the sun. The Mexicans maintained that there was a rabbit in the moon's disk, and this was connected with one of their myths. In Central America, the moon is figured upon certain structures as a pitcher, or as a spiral shell whence a hare is emerging.

[According to Iroquois tradition, an old woman gifted with the power of divination was unhappy because she could not also foretell when the world would come to an end. For this, she was transported to the moon, where to this day she is seen weaving a forehead strap. As once a month she stirs a kettle of hominy, an ever-present cat unravels her net, so her work will never be finished.]

When we pass from North to South America, the image placed by popular belief on the globe of our satellite undergoes an entire change, and the hare and rabbit give way to a human figure. The Incas relate that a courtesan, promenading on a moonlight night, was taken with the beauty of the star, and, wishing to own it, rushed toward it in order to embrace it. The moon clasped her with a vigorous movement, and still holds her.

In the Samoan Archipelago they distinguish a woman and her child, who have been transported to the moon. On the Book Islands, men are seen in the moon, and at Timor, an old woman spinning. The principal African nations, especially those of the south, distinguish a human face.

The ancient Scandinavians connected the spots on the moon with a legend: "Mane," says the Edda, "regulates the course of the moon and its different quarters. One day he carried off two children, Bil and Hiuke, as they were coming from a fountain carrying a pitcher suspended from a stick. These two children have not left the moon, as every one may see."

[To the poets, the spots represent the boy Endymion, whom Diana loves so well that she carries him with her.]

In the explanation of the Eskimos of Greenland, Anninga, the moon, brother of the beautiful Malina, the sun, was one day chasing his sister, and was about reaching her, when she turned, and, with her fingers all black from the soot of a lamp, besmeared the face and clothes of Anninga, who has always carried the marks thereof.

The Khasias, who think that the moon is burned every month by the sun, see in the spots on its disk the ashes resulting from such combustion.

[The Jews have some Talmudical story that Jacob is in the moon, and they believe that his face is visible.]

The Greek vision of a maiden's face has been transmitted to the Latin nations. Peoples of German origin incline more to the image of a little man bent under the weight of a burden. Shakespeare speaks several times of a man near whom is observed a dog and a bush.*

In France, according to locality, the peasants think they see in the moon the figure of the traitor Judas; Judas hanging from an elder tree branch; Jean de Navets, wheeling his barrow full of stolen turnips; the fratricide Cain resting upon his spade and looking at the innocent Abel lying at his feet;† a peasant guilty of having cut wood on the domains of his lord, and snapped up by the moon; a peasant who went to fence his field in on Sunday, and who was condemned to freeze in the moon, loaded down with a fagot of thorns; a hunter and his dog; a she goat and her keeper, who is milking her near a bush, and always with the everlasting fagot.

[Another and very ancient superstition is that the lines and spots on the moon's disk are the figure of a man leaning on a fork, on which he carries a bundle of thorns or brushwood, for stealing which, on a Sunday, he was confined in the moon—a belief probably based on the account given in Numbers xv. 32 of a man who was stoned to death for gathering sticks upon the Sabbath.]

It is unnecessary to say that with a good telescope we perceive simply luminous and dark areas, and detect mountainous regions and craters of extinct volcanoes. Some astronomers find a great resemblance to the tail of a peacock, or to the appearance exhibited by powdered plaster, irregularly arranged and thoroughly wet, upon which the sunlight is falling.

During eclipses of the moon, men of ancient times experienced the greatest fear. Total eclipses of the sun are very rare. There occurs but one at the most per century, in a given place, and it lasts hardly five minutes. The partial eclipses of this star produce no more effect than an interposition of the clouds, so that such phenomena occurred without exciting attention. The same was not the case with lunar eclipses, which take place at the moment of the full moon. As our satellite is then visible all night if the heavens are clear, we easily follow the changes that occur on its disk.

When the moon was eclipsed, the Incas believed it to be sick. As soon as it began to be observed, a feeling of inquietude prevailed. If it entirely disappeared, it was the sign of certain death. It could no longer sustain the heavens, it would fall upon the earth and crush poor mortals, and the earth would end. So, as soon as one of these eclipses was seen, the dates of which were unknown, every one grabbed whatever instrument he could put his hands upon—drums, trumpets, kettles—and made a frightful noise. Dogs were tied up and whipped in order to make them howl dolefully, under the belief that the moon loves these animals, and that, touched by their groans, it would make an effort to revive. It is probably for this reason that we say of a dog barking at night that he is baying at the moon. Did the Greeks of classical antiquity speak otherwise of Diana, the huntress?

In Peru, during lunar eclipses, the men, women, and children cry in deafening unison, "*Mama quilla, mama quilla!*" *i. e.*, "mamma moon," supplicating the celestial powers not to let them die. When the light returns, they praise the great god Pachacamac, the upholder of the universe, who has cured the moon, and, through this, has prevented it from putting an end to the existence of men.

The Huron and Carib Indians had about the same ideas. The terrible Carib demon Maboya, who is the author of frightful apparitions, sickness, thunder, and tempests, tries to devour the star of night. In order to put the monster to flight, a great racket was made by striking pieces of bark, drums, and kettles, and especially by shaking the *maracas* (gourds containing pebbles). The Caribs, young and old, men and women, then danced all night, jumping with the feet joined, one hand upon the head and the other upon the buttock, without singing, but uttering mournful and terrible cries. Those who had begun to dance were obliged to continue until daybreak, without daring to quit, no matter what the necessity. Meanwhile, a girl shook a gourd containing some pebbles, and tried to attune her coarse voice to this tiresome racket.

The Eskimos hide their provisions and close their dwellings, for fear that the sun or moon may enter. The men utter cries and strike resounding blows, and the women pull the dogs' ears. If these animals howl, the end of the world is not yet near, since they existed before man and have a much more certain presentiment of the future.

[Whenever there is a lunar eclipse, the Odjibway Indians say *gisiss nibo*, "the moon is dying."]

Some South American tribes think that, during eclipses, the moon is devoured by a gigantic dog. The Guaranis think that the animal is a jaguar, and the ichthyophagous Makahs of the strait of Fuca think it is a shark that does it. On such occasions many tribes shoot arrows into the air in order to drive away the pretended enemies of the sun and moon. This recalls an exploit of Alphonso VI., King of Portugal (1664), who, learning that a comet, the precursor of the death of a sovereign, had been observed in the heavens, ran out to look at it, and, after insulting it, shot at it with a pistol several times!

The Scandinavians had pretty much the same ideas. The moon and the sun, Mane and Sunna, which are brother and sister, are walking fast, pursued by two terrible wolves ready to devour them. The most dreaded one is Managarmer, a monster who fattens upon the substance of moribund men, and sometimes eats the moon and spills blood in the heavens and air.

Despite the relatively advanced state of astronomy among the Hindoos, this people preserves in the heavens the head and tail of a dragon that tries to devour the sun and moon during eclipses. These are the two nodes of the lunar orbit upon the ecliptic. The duration of the revolution of the line of the nodes is still called the draconic period.

We find an analogous tradition among the Hebrews. The author of the Apocalypse represents to us a draped woman in the sun who has the moon under her feet, and who wears a diadem surmounted with twelve stars. A seven-headed dragon, capable of carrying along with its tail a third of the stars of the heavens, is waiting to devour the fruit that this woman is going to put into the world.

In the popular beliefs of Sumatra and Malacca, the darkening of the star is caused by a great serpent, which encircles it in its coils. The Alfourous of Ceram believe that the moon is asleep during eclipses, and they beat a drum in order to awaken it. The Siamese still think that eclipses are caused by the malignity of a dragon that devours the sun or moon. They therefore make a great din with stoves and kettles in order to drive this pernicious animal away. The learned understand these phenomena, and know that they can be foretold and their return be calculated. The same is the case in China; but in this eminently conservative country, the very court and authorities of the empire have indefinitely perpetuated the traditions of primitive times. An eclipse of the sun was a warning to the emperor to examine his faults and make amends for them. If the phenomenon was announced by the official astronomer, news of it was given throughout the empire, and the court prepared for it by fasting and seclusion. On the day fixed, the phenomenon was everywhere awaited with anxiety. As soon as the star began to be observed, or, to use the Chinese expression, as soon as it began to be eaten, the emperor himself gave the alarm by beating "the roll of wonder" on the thunder drum. The mandarins, who had come with their bows and arrows "to assist" the eclipsed star, shot into the air uninterruptedly. The educated Chinese know that these are but forms, but the superstition still prevails among the masses, who fall on their knees at the beginning of an eclipse, strike the earth with their foreheads, and make a great noise with drums and gongs in order to deliver the star from the dragon that threatens to devour it.

The Greek and Latin authors (Plato, Pliny, Livy) tell us that a great noise was made during eclipses. The early Christians rang bells, not only during storms, but during eclipses also, in order to war against the action of malevolent spirits, and to repulse, according to the consecration of the priest, the darkness caused by phantoms (*umbra phantasmata*), a relic of the dark genii that devour the moon.

(*To be continued.*)

*See Midsummer Night's Dream, act iii., scene i., and Tempest, act ii., scene ii.

†This is the Italian idea, too. Dante, in the Inferno, describes the moon by the periphrasis, "*Caino e le spine.*"

Trained Mechanics.

It is a notable fact, and one, too, not generally known, says the *Industrial World*, that some of the "best all-around" mechanics, *i. e.*, those who can turn their hands to all kinds of general machine work, are men who learned their business in small shops, where all sorts and all classes of work are done. An ingenious, thinking man placed in such a shop has the best possible chance to develop all the talent there is in him. The hundred and one odd jobs required to be done will cause him to devise ways and means, and "to think," and in these ways he will grow to be a man fertile in resources, dexterous in touch, and ready for nearly any kind of work which may come along. Now mark the difference: A man trained in a large shop, with its score or more of departments, learns or works through as a rule one, two, or three different departments, of course becoming an expert in the several branches; but should occasion arise for him to do some particular work of which he has but a slight knowledge, he is out of his latitude, and makes poor progress, simply because he has not done all kinds of work; while the man trained in the small shop can adapt his hand to almost anything which turns up.

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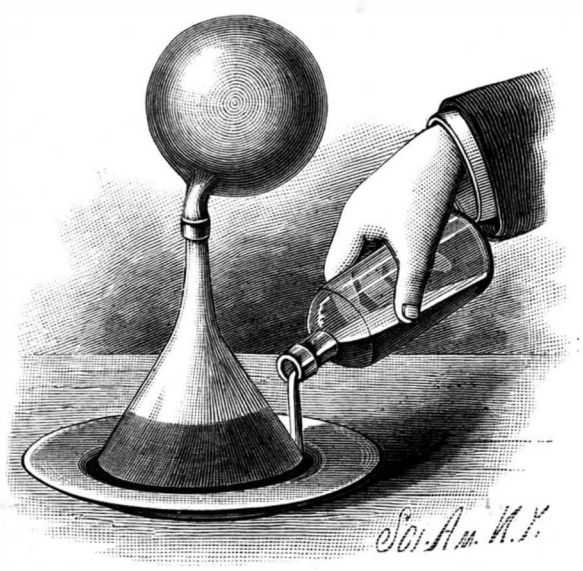
EXPERIMENT IN CAPILLARY ATTRACTION.

T. O'CONOR SLOANE, PH.D.

Few subjects are so fertile in simple experiments, requiring little or no special apparatus, as capillary attraction. Faraday, who was unrivaled as a popular lecturer, continually employed the simplest possible methods of illustrating the action of this subtile force. One of the most striking he performed thus: A pile of salt was placed upon a plate. The lecturer then poured into the plate a saturated solution of



EXPERIMENT IN CAPILLARY ATTRACTION.

salt in water. The solution was colored to make it easily visible. As it was poured about the base of the salt, it was drawn up through the pores existing between the grains. By the operation of capillary force the colored solution gradually rose upward, coloring the salt as it ascended.

The clew to the success of this experiment is in the use of the salt solution instead of plain water. Were the latter used, it would rapidly disintegrate the pile of salt, by dissolving it. With the saturated solution the solid salt is quite unaffected.

In the illustration is shown a modification or development of this experiment. The apparatus required is a little more extensive, as, in addition to the plate, a glass funnel and an India rubber balloon are needed.

The balloon should be inflated to its largest size and kept so for some time, so as to stretch the rubber well. This is to enable it to fill at low pressure. The glass funnel should be as large as possible, as the demonstration is more satisfactory when executed on a large scale.

The funnel is filled with perfectly dry salt, well pulverized, which is pressed in as hard as possible. The funnel is completely filled with it, when supported mouth upward. The filling may be carried a little above the rim. The plate is then placed over its mouth so as to bear against the salt, and the whole is inverted. The object is to so conduct the operation that the salt shall not settle down or change its position, but shall remain in close contact with the walls of the funnel. All these precautions are quite essential to success.

The mouth of the balloon, whence the air has been expelled, is now sprung over the open end of the funnel as shown in the cut. It is not necessary to tie it on. The balloon must, of course, be perfectly empty.

The plate, funnel, and balloon are now ready for the experiment. A saturated solution of salt should have been prepared. This is made by shaking in a bottle an excess of salt with water. As salt is more soluble in cold than in hot water, this operation must be done at ordinary temperatures. As coloring matter, a little ferric salt with sulphocyanide of ammonium may be added, or any ink that is soluble in water may be used.

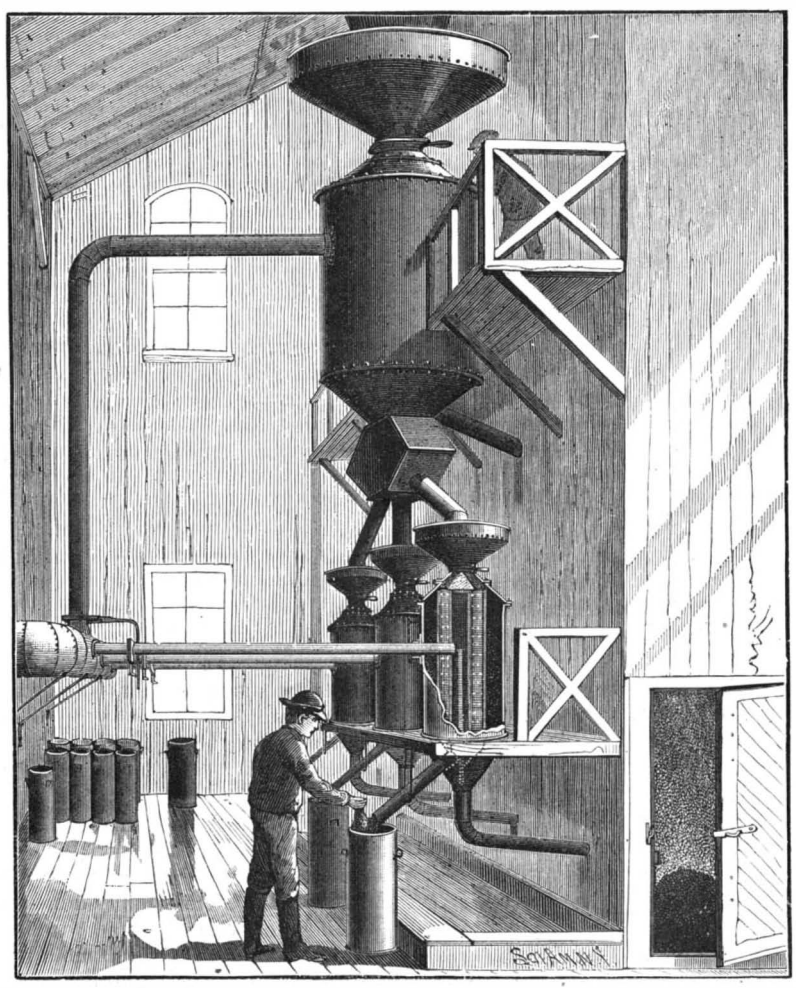
The solution is now poured into the plate so as to rise above the edge of the funnel and keep it immersed. It at once rises through the salt, coloring it as it ascends. As fast as it rises, it of course leaves the plate. Hence the experimenter must make repeated additions of solution. As the fluid rises, it drives out the air before it. This would escape from the mouth of the funnel. But the balloon which has been placed there intercepts its escape. The air enters and rapidly inflates it. The pressure thus produced is slight. It cannot do more than just fill the balloon. It cannot distend it But by having the balloon well stretched, its inflation can be made quite conspicuous.

If, by settling, the salt has left any space between itself and the walls of the funnel, the possible pressure, slight at the best, will be greatly diminished. If the balloon exerts the least back pressure, air will bubble out of the weak spots around the rim of the funnel.

By substituting a cone of porous clay for salt, a more permanent apparatus could be readily constructed.

AN IMPROVED BOLT.

An improved bolt or separator for cleaning bone black and other dry pulverized or powdered substances is illustrated herewith, and has been patented by Mr. George D. Murdoch, of No. 523 Clinton Street, Brooklyn, N. Y. Within a main cylindrical casing, having preferably a conical top and bottom, a small interior cylinder is centrally and vertically supported, beneath a hopper secured to the top of the casing, there being a slide in the bottom of the hopper to regulate the amount of material passing into the casing. The central cylinder has a solid conical cap covering its top, and is made of wire gauze or other open material, an aperture being formed in one side, above the center, in which a pipe is entered connected with any pressure blower, making this cylinder an air flue. Opposite the entrance of the pipe and surrounding it is a plate attached to the screen of the cylinder, whereby the air entering is disseminated throughout the cylinder, instead of being concentrated at one point. A second gauze cylinder surrounds the central one, the space intervening containing coils of wire, to act as deflecting rods and break up the material should it enter from the hopper in a mass. This outer cylinder is attached at the top to the upper cone, below the cap of the inner cylinder, so that material fed from the hopper will be guided into it by the cap, and extends downward below the inner cylinder, being provided at its base with an outlet pipe through one side of the lower conical head. The mouth of the pipe entering the inner cylinder from the pressure blower has a vertical semicircular partition, through which passes one end of a tube, that extends down through the inner cylinder, and below the bottom of the outer gauze cylinder, to a point just above the outlet pipe at the bottom of the cone-shaped lower end of the casing. In operation, as the air is forced through the meshes of the inner cylinder upon the material as it is dropped down over the spirals in the outer cylinder, the dust from the material is blown through the gauze meshes of that cylinder into the space between it and the outer casing, whence it falls to the outlet pipe at the bottom and is driven out. The material that is cleaned and separated by the blast as it passes over the spirals drops to the bottom of the outer gauze cylinder, and is thence conveyed by its outlet pipe to any convenient point. Our illustration shows one large bolt and three smaller ones arranged in connection with each other according to this construction, it being obvious that a number of successive bolts can be thus employed for the separation of material into different degrees of fineness according to the fineness of the meshes in the cylinders.

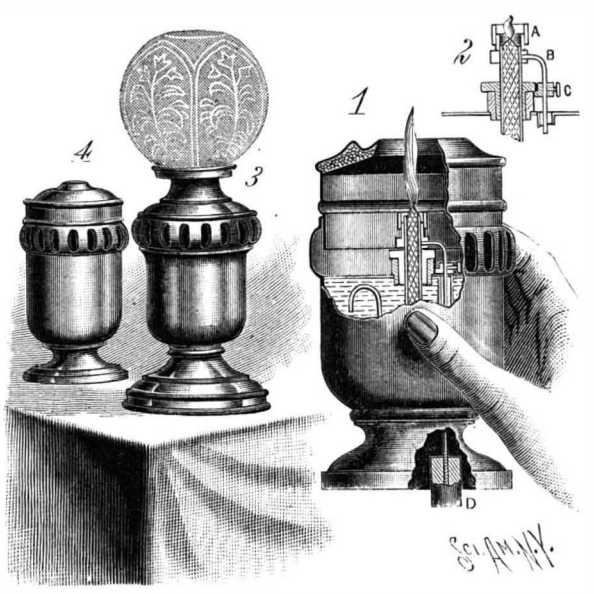


MURDOCH'S BOLT FOR CLEANING DRY PULVERIZED OR POWDERED SUBSTANCES.

THE South African diamond fields last year yielded gems valued at over $20,000,000.

AN IMPROVED NIGHT LAMP.

An invention providing means for regulating the flame of a lamp, so that when not in use the flame may be lowered and raised as required, has been patented by Mr. Theodor Bergmann, of Gaggenau, Baden, Germany, and is illustrated herewith, Figs. 1 and 2 being sectional views, and Fig. 4 showing its application as a cigar lighter. The invention consists of a regulating sleeve applied to the wick tube, which is secured to a top plate over the burning fluid by a thimble screwing into a bushing. Upon the wick tube is a sliding sleeve,



BERGMANN'S "ALADDIN" LAMP.

A, to which is secured a downwardly extending rod, B, passing through a tube in the fount, and carrying at its lower end a weighted block, D, adjustable on the rod by a screw thread. Near the angle of the bent part of the rod is a stop device, C, adjustable by means of a set screw, whereby the vertical movement of the rod is limited, and this may also be effected by adjusting the weighted block, when the stop device may be dispensed with. When the lamp is raised by the hand the weighted block drops so as to depend partly below the base, drawing down the sleeve to bring it even with the top of the wick tube, thus causing the flame to enlarge and rise up through the opening in the top of the hood. Upon placing the lamp on any suitable resting place, the depending block strikes thereon and rises, pushing up the sleeve by means of the connecting rod past the flame, so as to lower the flame without extinguishing it. The degree to which the flame is to be enlarged or lowered may be regulated by adjusting either the block or the stop device. It is said that large quantities of these lamps have been sold in the European markets.

For further particulars with reference thereto, address the owners, Gaggenau Iron Works, Baden, Germany.

The Great Yellowstone Geyser Now Active.

A dispatch to the Chicago *Tribune* says the Excelsior geyser in the Yellowstone Park is in operation. This geyser is in the great middle geyser basin, close to Fire Hole River. It is in the form of an immense pit 320 feet in length and 200 feet wide, and the aperture through which it discharges its volume of water is nearly 200 feet in diameter. Its general appearance is that of a huge boiling spring, and for many years its true character was not suspected. Its first eruption occurred in 1880, when it revealed itself as a stupendous geyser. The power of its eruptions was almost incredible, sending an immense column of water to heights of from 100 to 300 feet, and hurling with it rocks and bowlders of from 1 to 100 pounds in weight. Its present eruption is said to be a repetition of that of 1880. It is throwing its volumes of water 300 feet into the air, and Fire Hole River is reported to have risen two feet from its rushing floods. This is now conceded to be the most powerful geyser in existence.

The Edison Photophone.

The editor of the *Western Electrician* thinks the Edison photophone possesses such vast possibilities and its achievement has awakened an enthusiasm which has not been manifest since the introduction of the telephone. It may, he thinks, serve a thousand different purposes. It may aid the business man throughout the working hours and charm him in his leisure moments. Employed as it can be for both pleasure and business, it may revolutionize life in both these aspects.

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ENGINEERING INVENTIONS.

An indicator for boiler feeds has been patented by Mr. William H. Rodgers, of Whitestone, N. Y. It has an alarm mechanism normally held set by a fusible plug, two signal disks being arranged in connection therewith, so mounted that when the pump or injector is working, the safety disk will be exposed and the danger disk covered, and *vice versa*.

A fire extinguisher for railroad cars has been patented by Mr. George W. Oborn, of Columbus, Ohio. The invention consists in connecting the stoves and lamps with a tank of fire extinguishing liquid, and the tank with the air brake drum or cylinder by a valved pipe, so that in case of accident compressed air will force the extinguishing liquid upon the fire.

A car heating and ventilating apparatus has been patented by Mr. Jacob T. Earnest, of Jacksonville, Fla. In combination with an air blower and closed water tank with spray pipes, the invention covers various other novel features of an apparatus for supplying railroad trains with pure air, either heated or cooled, and suitably moistened, while also removing the vitiated atmosphere.

A draw gear for railway cars has been patented by Mr. Chas. H. Starr, of Logansport, Ind. It consists essentially of a pair of flanged channel irons, in the flanges and sides of which are transverse gains or slots to receive the bolts by which the draw spring cage and the bolster bearing are bolted to position, the channel irons being arranged for connection with the draught sill.

A rail joint has been patented by Mr. John V. Koss, of North Yakima, Washington Ter. It consists of a chair having a fixed rail and sliding rail sections, with intervening spring joints, and other novel features, to provide for the expansion and contraction of the rails, and has especial reference to keeping switch rails in order, and preventing them from becoming jammed and out of order.

A railway signal has been patented by Mr. Charles D. Tisdale, of Boston, Mass. It is a semaphore, to be operated by a weight under control of an electro-magnet, a hollow post being adapted to contain the operating mechanism of the semaphore, a lamp being supported by the post to throw light through windows of the semaphore arm, while there is a removable handle for turning the shaft and winding the weight cord.

MISCELLANEOUS INVENTIONS.

A cough mixture has been patented by Mr. George Wood, of Crawford, Col. It consists of extract of blood root, essence of anise, essence of sassafras, essence of lobelia, and other ingredients, compounded and administered in a special manner set forth.

A clasp has been patented by Mr. William Bloomberg, of New York City. The invention consists in a peculiar form of blank employed in constructing the main jaw of the clasp, for holding suspender ends without stitching, and uniting them to the suspender buckle.

A ship's log has been patented by Mr. Oscar Kustel, of San Francisco, Cal. This invention covers a novel construction and combination of parts in a device wherein the distance sailed or steamed by a vessel in a given time will be recorded in knots, and the record will be open to inspection at all times.

A handkerchief holder has been patented by Mr. Stephen M. Griswold, of Brooklyn, N. Y. This invention provides an article in the form of a brooch, with a pin, to hold a handkerchief as in a clasp, while the device may be made in gold or silver or other material to make an attractive ornament.

A collar and cuff drier and dampener has been patented by Mr. John G. Dixon, of New York City. This invention provides means whereby collars and cuffs may be carried in quantities through a suitable heated chamber, and subject to exposure equally on both sides, and afterward be automatically sprinkled equally on both sides, ready for ironing.

A thill coupling has been patented by Mr. Joel S. Pardee, of New Troy, Mich. It is a simple and inexpensive coupling which may be quickly engaged with or disengaged from a stud on a vehicle thill or pole, to allow either thills or a pole to be used for harnessing one or more horses, while also arranged to be an effective anti-rattler.

An automatic weighing scale for liquids has been patented by Mr. Paul Witteck, of Butler, N. J. It has a reversible measure, with means for automatically supplying the matter to be weighed to the measure and automatically emptying the measure when filled, the invention covering various novel features of construction and the combination of parts.

A cork holder for bottles has been patented by Mr. William Beardsley, of Beacon, Iowa. It consists of a cap piece with an enlarged central portion to form a cap or hood over the cork, and with opposite side arms or extensions adapted to engage a compensating neck band, which may be arranged around bottle necks of different sizes.

A method of manufacture of felt hats, caps, etc., has been patented by Mr. Frederick W. Cheetham, of Hyde, Chester County, England. It consists in first forming the complete body or form according to whether it is to be soft or stiff, then working or felting a covering of fine short staple wool upon the coarser body, finally finishing it.

A sweat pad has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter. It has one or more openings or slots extending through it, combined with a hook having both ends made alike, and adapted to have either end seated in the slot, to constitute a reversible pad for protecting the neck and shoulders of a draught animal.

A sewing machine has been patented by Mr. Charles P. Bostian, of Milton, Pa. Two needles are carried by the needle bar at an angle to the width of and both entering the same race, with mechanism for bringing the points of the needles into position within the race for the single shuttle to take both loops, thus making simultaneously a double row of stitches.

A wall covering composition has been patented by Mr. Carl Straub, of Syracuse, N. Y. It is made of wood fiber, cement, and a hardening acid, compounded in proportions and manner described to make a composition only about half as heavy as mortar, but more elastic, and of uniform density or hardness.

A button machine has been patented by Mr. Albert Wittig, of New York City. It consists of a press with revolving bed carrying dies and having a cutting block for supporting cloth for covering buttons, being designed for the use of tailors, etc., to enable them to provide buttons covered with the material of which the garment is made.

A suspender attachment has been patented by Mr. Charles H. Scales, of Toronto, Ontario, Canada. It is an improvement in buckles for connecting the continuous doubled straps forming the ends of self-adjusting suspenders to the webs, while allowing the straps to run freely, securing the ends from displacement when not attached to a garment.

A gate roller and hinge has been patented by Mr. James G. Swarthout, of Stone's Prairie, Ill. It has a roller wheel with ball bearing, on which the roller may turn and swing in opening and closing a gate supported on the roller, forming a gate roller and hinge supported in and connected with two hinge posts, so that the gate may be moved endwise or swung around.

SCIENTIFIC AMERICAN
BUILDING EDITION.

MAY NUMBER.—(No. 31.)

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16. Perspective and floor plans of two modern dwellings, costing eight thousand dollars and two thousand eight hundred dollars respectively.
17. Plans and perspective elevation for a two thousand two hundred dollar house.
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19. Elegant residence of Dr. J. S. Hurlbut, Esq , School Street, Springfield, Mass.
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Lockwood's Dictionary of Terms used in the practice of Mechanical Engineering, embracing those current in the drawing office, pattern shop, foundry, fitting, turning, smith's and boiler shop, etc., comprising over 6,000 definitions. Edited by a foreman patternmaker. 1888. Price, $3.00. For sale by Munn & Co., 361 Broadway, New York.

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Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

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LA GALVANOPLASTIE, LE NICKELAGE, LA DORURE, L'ARGENTURE, ET L'ELECTRO-METALLURGIE. Par Emile Bouant, Professeur au Lycee Charlemagne. Small 8vo, pp. 303. With 34 figures inserted in the text. Paris: Librairie J. B. Bailliere et Fils. 1887.

In this little volume, Professor Bouant, after a brief *expose* of the history and present state of the electrolytic arts, proceeds to a description of the various processes employed in electrotypy, electro-chemistry, and electro-metallurgy. The directions and formulas for each process are given in minute detail and with remarkable clearness, and any one who follows them to the letter will undoubtedly obtain successful results, and that too with the simplest of appointments. The electrolytic arts, in fact, are peculiar in that they need no very extensive establishments for their development, but may be practiced in the humblest of shops or in the laboratory of the amateur. In view of the fact that the applications of electrotypy and the other branches of electrolysis are daily becoming more numerous, this little work will prove a valuable and welcome addition to the library of the practical metallurgist, as well as to that of the amateur.

Old South Leaflets. This is the title of a series of pamphlets on various subjects of importance. Their titles sufficiently identify their purpose and aim. No. 1. Constitution of the United States. 2. Articles of Confederation. 3. Declaration of Independence. 4. Washington's Farewell Address. 5. Magna Charta. 6. Vane's "Healing Question." 7. Charter of Massachusetts Bay, 1629. 8. Fundamental Orders of Connecticut, 1638. 9. Franklin's Plan of Union, 1754. 10. Washington's Inaugurals. 11. Lincoln's Inaugurals and Emancipation Proclamation. 12. The Federalist, Nos. 1 and 2. 13. The Ordinance of 1787.—etc. Price, five cents per copy, one hundred copies, three dollars. Published by D. C. Heath & Co.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) J. E. W. asks how to splice a belt in order to make it run as near like an endless belt as possible—not the old, rough way of splicing. A. Use the toughest yellow glue prepared in the ordinary way, while hot, stirring in thoroughly about 20 per cent of its weight of tannic acid, or extract of tan bark. Apply to the splice and quickly clamp together. The splice should be made of scarfed edges extending 3 to 6 inches back, according to thickness of belt. The surface to be perfectly clean and free from oil.

(2) E. V. H. desires a recipe of some preparation that will make leather waterproof. A. There is no way of making leather absolutely waterproof. Good tanning and currying, with the grain or hair side out, and the frequent use of stuffing makes leather nearly waterproof.

(3) M. M.—The word lye is used to indicate the solution of a caustic or carbonated alkali, such as caustic soda, soda ash, or carbonate of potash.

(4) H. J. M.—For Babbitting small boxes, use a spindle of iron turned smooth, for the journal. Set the box and spindle in proper position in moulding sand as dry as will stick together. Ram the sand gently to close the opening between box and spindle, and pour the metal. If the box is solid the spindle may be very slightly taper, and by gently rapping it sidewise, it will easily drive out.

(5) J. W. T.—The following combined toning and fixing bath is recommended:

Chloride of gold	1 grain.
Phosphate of soda	15 "
Sulpho cyanide of ammonium	25 "
Hyposulphite of soda	240 "
Water	2 ounces.

Dissolve the gold first in a small quantity of water, then add as above. See our book catalogue. The book by Ellerslie Wallace is recommended.

(6) J. L. V. asks a receipt for making compressed yeast. A. This yeast is obtained by straining the common yeast in breweries and distilleries, until a moist mass is obtained, which is then placed in hair bags, and the rest of the water pressed out until the mass is nearly dry. It is then sewed up in strong linen bags for transportation.

(7) W. W. McV. desires a receipt for making good dark mahogany stain for elm wood. A. Boil ½ pound of madder and 2 ounces logwood chips in a gallon of water, and brush well over while hot. When dry, go over them with a pearlash solution having the strength of 2 drachms to a gallon.

(8) D. F. W. asks how vaseline is purified for barbers' use. A. The residuum from which vaseline is made is placed in settling tanks heated by steam, in order to keep their contents in a liquid state. After the complete separation of the fine coke it is withdrawn from these tanks and passed through the bone black cylinders, during which process the color is nearly all removed, as well as its empyreumatic odor. See Crew's "Practical Treatise on Petroleum," which we can send you, post paid, for $4.50. See also SCIENTIFIC AMERICAN SUPPLEMENT, No. 153.

(9) A. E. S. asks the best preparation for waxing silk thread for binding gut snells on to very small fish hooks. A. Yellow beeswax is ordinarily used. Shoemaker's wax is very good also. The following mixture will render it waterproof. Take 2 parts boiled oil, 1 part gold size, put into a bottle, shake well and it is ready for use. Apply with a flannel, expose to the air and dry.

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(10) A. A. asks (1) the proper proportion for compounding sulphur and molasses, to be used as a blood purifier, and how it is to be taken? A. Take 2 teaspoonfuls of sulphur, and 1 of cream tartar, and mix with sufficient molasses, so that it will not be too stiff. It is taken in doses of a teaspoonful once or twice a day. 2. Which is the best known manner of purifying the blood? A. This depends upon so many conditions that it is best for you to consult a physician.

(11) J. B. desires a receipt for making a good ink used for shading, with three different sized shading pens. A. See the receipts given in the article on "Inks," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157.

(12) O. R. asks for a book from which he can learn how to stuff birds. See Brown's Practical Taxidermy, which we mail for $2.50, or Batty's Practical Taxidermy and Home Decoration, $1.50.

(13) C. H. D. asks how to make an article called razor paste. A. Emery reduced to an im. palpable powder 2 parts, spermaceti ointment 1 part, mix together and rub it over the strop. See Spon's "Workshop Receipts," first series, which we mail for $2, for several similar recipes.

(14) C. L. L. desires a receipt for making the black cement or paste that is used for filling letters after they are cut out in brass. A. Mix asphaltum, brown japan, and lampblack into a putty like mass, fill in the spaces, and finally clean the edges with turpentine.

(15) T. M.—The paste mostly used in mounting photographs is nothing more than pure laundry starch mixed with cold water to moisten it, and thinned down to proper consistency with boiling water. If there are lumps, it should be strained through a fine cloth. Some add a little camphor to preserve it.

(16) C. A. R. asks if a thermo-electric pile can generate enough current to run a motor, and if so, how large one should be. A. A thermo-electric battery can be so used, but with very low efficiency. Its size would depend on the energy absorbed by the motor.

(17) S. L. S. asks: 1. About how long can a man live, without serious inconvenience, if placed inside a tight iron casing containing 100 cubic feet of air? A. A very few minutes would practically exhaust the air, for though it would take some time to breathe all of it, it would rapidly become so contaminated as to exercise a toxic and weakening effect. 2. Is there any simple means by which the air in such a casing can be kept pure enough, so that a man can live in it a longer time? A. Caustic soda or potash would absorb carbonic acid gas, and a well exposed solution of permanganate of potash or of bleaching powder would remove the organic impurities. Then a man could endure the confinement much longer. 3. What pressure per square inch is necessary to compress air to half its bulk? A. Double the atmospheric pressure, or fifteen pounds per square inch, by a pressure gauge set to zero in the atmosphere. 4. What pressure per square inch can a man endure and work in without injury? A. Three atmospheres, or thirty pounds to the square inch, plus the natural pressure, is pretty severe. It depends on the constitution.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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May 15, 1888,

AND EACH BEARING THAT DATE.

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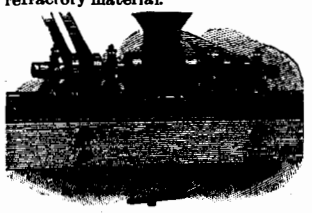

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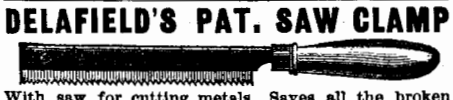

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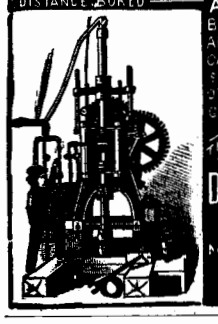

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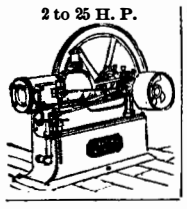

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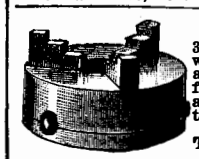

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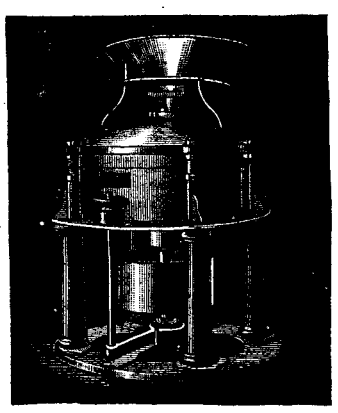

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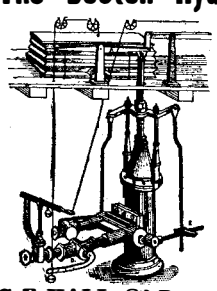

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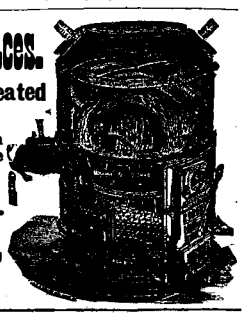

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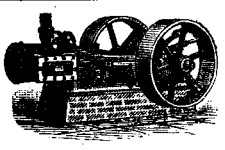

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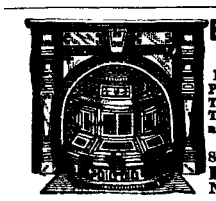

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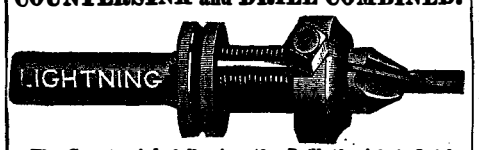

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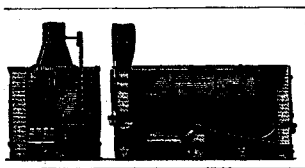

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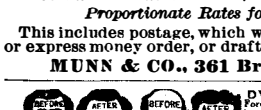

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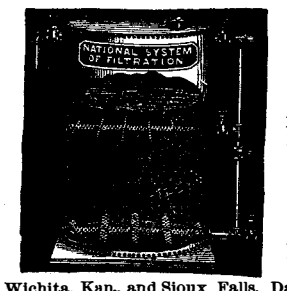

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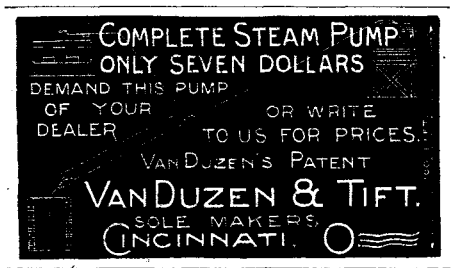

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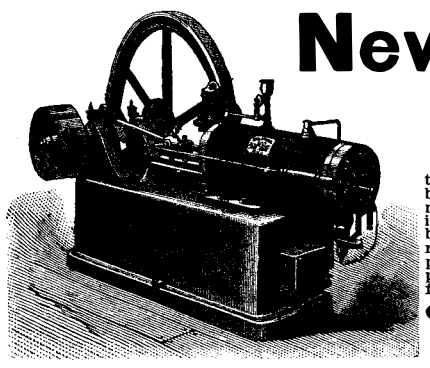

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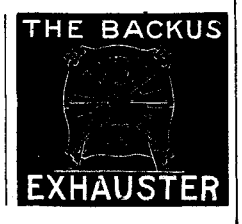

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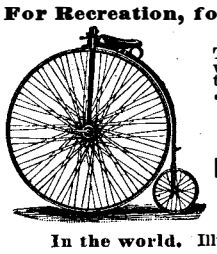

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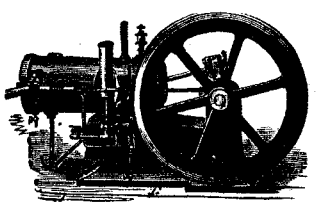

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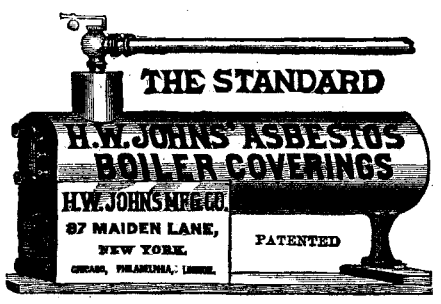

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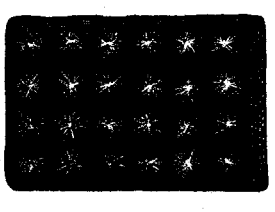

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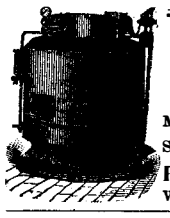

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